§1971.1.1. On-Board Diagnostic System Requirements--2010 and Subsequent Model-Year Heavy-Duty Engines. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) *Purpose.*

The purpose of this regulation is to reduce motor vehicle and motor vehicle engine emissions by establishing emission standards and other requirements for onboard diagnostic systems (OBD systems) that are installed on 2010 and subsequent model-year engines certified for sale in heavy-duty applications in California. The OBD systems, through the use of an onboard computer(s), shall monitor emission systems in-use for the actual life of the engine and shall be capable of detecting malfunctions of the monitored emission systems, illuminating a malfunction indicator light (MIL) to notify the vehicle operator of detected malfunctions, and storing fault codes identifying the detected malfunctions. The use and operation of OBD systems will ensure reductions in in-use motor vehicle and motor vehicle engine emissions through improvements of emission system durability and performance.

(b) *Applicability.*

Except as specified in section (d)(7) and elsewhere in this regulation (title 13, CCR section 1971.1.1), all 2010 and subsequent model-year heavy-duty engines shall be equipped with an OBD system that has been certified by the Executive Officer as meeting all applicable requirements of this regulation (title 13, CCR section 1971.1.1).[3]

(c) *Definitions.*

"Actual life" refers to the entire period that an engine is operated on public roads in California up to the time an engine is retired from use.

"Alternate-fueled engine" refers to an engine using a fuel different from or in addition to gasoline fuel or diesel fuel (e.g., compressed natural gas (CNG), liquefied petroleum gas). For the purposes of this regulation, alternate-fueled engines include dedicated alternate-fueled engines (i.e., engines designed to operate exclusively on the alternate fuel) and engines that can use more than one type of fuel but cannot be reasonably operated in-use exclusively on gasoline or diesel fuel (e.g., engines with diesel pilot injection and CNG main injection where engine operation is limited to idle if CNG fuel is not available or engines which use gasoline-only operation during cold start and CNG-only operation for the rest of the driving cycle and engine operation defaults to a limp-home restricted speed and load if CNG fuel is not available). For engines that can use more than one type of fuel but can be operated in-use exclusively on gasoline or diesel fuel, the engines are considered alternate-fueled

[3] Unless otherwise noted, all section references refer to section 1971.1.1 of title 13, CCR.

engines only for the portion of operation the engine uses a fuel other than exclusively gasoline or diesel (e.g., a gasoline and CNG engine that can operate exclusively on gasoline is considered an alternate-fueled engine only while operating on CNG and is not subject to the provisions or relief of this regulation for alternate-fueled engines while operating exclusively on gasoline). For alternate-fueled engines, the manufacturer shall meet the requirements of section (d)(7.5).

"Alternate phase-in", as allowed in section (g)(5.8), is a phase-in schedule that achieves equivalent compliance volume by the end of the last year of a scheduled phase-in provided in this regulation. The compliance volume is the number calculated by multiplying the percent of engines (based on the manufacturer's projected sales volume of all engines unless specifically stated otherwise in section (e), (f), or (g)) meeting the new requirements per year by the number of years implemented prior to and including the last year of the scheduled phase-in and then summing these yearly results to determine a cumulative total (e.g., a three year, 20/50/100 percent scheduled phase-in would be calculated as (20*3 years) + (50*2 years) + (100*1 year) = 260; a two-year 20/50 percent scheduled phase-in would be calculated as (20*2 years) + (50*1 year) = 90). Manufacturers are allowed to include engines introduced before the first year of the scheduled phase-in (e.g., in the previous example, 10 percent introduced one year before the scheduled phase-in begins would be calculated as (10*4 years) and added to the cumulative total). However, manufacturers are only allowed to include engines introduced up to one model year before the first year of the scheduled phase-in. The Executive Officer shall consider acceptable any alternate phase-in that results in an equal or larger cumulative total by the end of the last year of the scheduled phase-in and ensures that all engines subject to the phase-in will comply with the respective requirements no later than two model years following the last year of the scheduled phase-in.

For alternate phase-in schedules resulting in all engines complying one model year following the last year of the scheduled phase-in, the compliance volume shall be calculated as described directly above. For example, a 20/50/100 percent scheduled phase-in during the 2016-2018 model years would have a cumulative total of 260. If the manufacturer's planned alternate phase-in schedule is 40/50/80/100 percent during the 2016-2019 model years, the final compliance volume calculation would be (40*3 years) + (50*2 years) + (80*1 year) = 300, which is greater than 260 and therefore would be acceptable as an alternate phase-in schedule.

For alternate phase-in schedules resulting in all engines complying two model years following the last year of the scheduled phase-in, the compliance volume calculation shall be calculated as described directly above and shall also include a negative calculation for engines not complying until one or two model years following the last year of the scheduled phase-in. The negative calculation shall be calculated by multiplying the percent of engines not meeting the new requirements in the final year of the phase-in by negative one and the percent of engines not meeting the new requirements in the one year after the final year of the phase-in by negative two. For example, if 10 percent of a manufacturer's engines did not comply by the final year of the scheduled phase-in and 5 percent

did not comply by the end of the first year after the final year of the scheduled phase-in, the negative calculation result would be (10*(-1 years)) + (5*(-2 years)) = -20. The final compliance volume calculation is the sum of the original compliance volume calculation and the negative calculation. For example, a 20/50/100 percent scheduled phase-in during the 2016-2018 model years would have a cumulative total of 260. If a manufacturer's planned alternate phase-in schedule is 40/70/80/90/100 percent during the 2016-2020 model years, the final compliance volume calculation would be (40*3 years) + (70*2 years) + (80*1 year) + (20*(-1 year)) + (10*(-2 years)) = 300, which is greater than 260 and therefore would be acceptable as an alternate phase-in schedule.

"Applicable standards" refers to the specific exhaust emission standards or family emission limits (FEL), including the Federal Test Procedure (FTP) and Supplemental Emission Test (SET) standards, to which the engine is certified.

"Auxiliary Emission Control Device (AECD)" refers to any approved AECD (as defined by 40 Code of Federal Regulations (CFR) 86.082-2 and 86.094-2).

"Emission Increasing Auxiliary Emission Control Device (EI-AECD)" refers to any approved AECD that: reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use; and the need for the AECD is justified in terms of protecting the vehicle against damage or accident. An AECD that is certified as an NTE deficiency shall not be considered an EI-AECD. An AECD that does not sense, measure, or calculate any parameter or command or trigger any action, algorithm, or alternate strategy shall not be considered an EI-AECD. An AECD that is activated solely due to any of the following conditions shall not be considered an EI-AECD: (1) operation of the vehicle above 8000 feet in elevation; (2) ambient temperature; (3) when the engine is warming up and is not reactivated once the engine has warmed up in the same driving cycle; (4) failure detection (storage of a fault code) by the OBD system; (5) execution of an OBD monitor; or (6) execution of an infrequent regeneration event.

"Base fuel schedule" refers to the fuel calibration schedule programmed into the Powertrain Control Module or programmable read-only memory (PROM) when manufactured or when updated by some off-board source, prior to any learned on-board correction.

"Calculated load value" refers to the percent of engine capacity being used and is defined in Society of Automotive Engineers (SAE) J1979 "E/E Diagnostic Test Modes," February 2012 (SAE J1979), incorporated by reference (section (h)(1.4)). For diesel applications, the calculated load value is determined by the ratio of current engine output torque to maximum engine output torque at current engine speed as defined by parameter definition 5.2.1.7 of SAE J1939-71 "Vehicle Application Layer (Through May 2010)," March 2011.

"Confirmed fault code," for purposes of engines using International Standards Organization (ISO) 15765-4, is defined as the diagnostic trouble code stored when an OBD system has confirmed that a malfunction exists (e.g., typically on the second

driving cycle that the malfunction is detected) in accordance with the requirements of sections (d)(2), (f), (g), and (h)(4.4).

"Continuously," if used in the context of monitoring conditions for circuit continuity, lack of circuit continuity, circuit faults, and out-of-range values, means monitoring is always enabled, unless alternate enable conditions have been approved by the Executive Officer in accordance with section (d)(3.1.1), and sampling of the signal used for monitoring occurs at a rate no less than two samples per second. If a computer input component is sampled less frequently for control purposes, the signal of the component may instead be evaluated each time sampling occurs.

"Deactivate" means to turn-off, shutdown, desensitize, or otherwise make inoperable through software programming or other means during the actual life of the engine.

"Diagnostic or emission critical" electronic control unit refers to the engine control unit and any other on-board electronic powertrain control unit that:

(1) has primary control over any of the monitors required by sections (e)(1) through (f)(9), (g)(1) through (g)(2), and (g)(4), but does not include circuit or out-of-range fault monitors required by sections (e)(9.2.1)(A)(ii), (e)(9.2.1)(B)(ii), (e)(9.2.2)(B), (e)(9.2.4)(B), (f)(8.2.1)(B), (f)(8.2.2)(B), (f)(8.2.2)(D), (f)(8.2.3)(A), (f)(8.2.3)(B), and (g)(1.1.2); or

(2) except for anti-lock brake system (ABS) control units or stability/traction control units,:

(a) has primary control over any rationality fault diagnostic or functional check for more than four input components or more than two output components required to be monitored by section (g)(3); or

(b) for 2016 and subsequent model year engines, is field reprogrammable and has primary control over any rationality fault diagnostic or function check for any input or output component required to be monitored by section (g)(3).

For purposes of criteria (1) and (2) above, "primary control" over a monitor means the control unit does any of the following: (a) determines if any enable conditions are satisfied; (b) calculates all or part of the diagnostic decision statistic or metric by which pass or fail decisions are made (e.g., the comparison of a component's measured or calculated level of performance to a fault threshold); or (c) makes or processes pass or fail decisions (e.g., debounces diagnostic decision statistics or commands MIL illumination or fault code storage). Further, for purposes of criterion (2)(a) above, all glow plugs in an engine shall be considered "one" output component in lieu of each glow plug being considered a separate component. Additionally, for purposes of criterion (2)(b) above, "field reprogrammable" means a control unit that is capable of supporting a manufacturer service procedure intended to be executed in a dealership or other vehicle service environment that results in the downloading of new software and/or calibration data into the control unit.

"Diesel engine" refers to an engine using a compression ignition thermodynamic cycle.

"Driving cycle" is defined as a trip that meets any of the four conditions below:

(1) Begins with engine start and ends with engine shutoff;

(2) Begins with engine start and ends after four hours of continuous engine-on operation;

(3) Begins at the end of the previous four hours of continuous engine-on operation and ends after four hours of continuous engine-on operation; or

(4) Begins at the end of the previous four hours of continuous engine-on operation and ends with engine shutoff.

For monitors that run during engine-off conditions, the period of engine-off time following engine shutoff and up to the next engine start may be considered part of the driving cycle for conditions (1) and (4). For vehicles that employ engine shutoff strategies that do not require the vehicle operator to restart the engine to continue driving (e.g., hybrid bus with engine shutoff at idle), the manufacturer may request Executive Officer approval to use an alternate definition for driving cycle (e.g., key on and key off). Executive Officer approval of the alternate definition shall be based on equivalence to engine startup and engine shutoff signaling the beginning and ending of a single driving event for a conventional vehicle. Engine restarts following an engine shut-off that has been neither commanded by the vehicle operator nor by the engine control strategy but caused by an event such as an engine stall may be considered a new driving cycle or a continuation of the existing driving cycle. For engines that are not likely to be routinely operated for long continuous periods of time, a manufacturer may also request Executive Officer approval to use an alternate definition for driving cycle (e.g., solely based on engine start and engine shutoff without regard to four hours of continuous engine-on time). Executive Officer approval of the alternate definition shall be based on manufacturer-submitted data and/or information demonstrating the typical usage, operating habits, and/or driving patterns of these vehicles.

"Emission standard," as it applies to OBD compliance and the remedies provided for in the Health and Safety Code for noncompliance, relates to the emission characteristics of a motor vehicle and engine and means:

(1) a numerical limit on the amount of a given pollutant that a motor vehicle or motor vehicle engine may emit into the atmosphere; or
(2) a requirement that a motor vehicle or motor vehicle engine be equipped with a certain type of pollution-control device or some other design feature related to the control of emissions.

"Engine family" means a grouping of vehicles or engines in a manufacturer's product line determined in accordance with 40 CFR 86.098-24 (eff. 2013).

10/2/20 PER AGENCY REQUEST LSM

"Engine rating" means a unique combination of displacement, rated power, calibration (fuel, emission, and engine control), AECDs, and other engine and emission control components within an engine family.

"OBD parent rating" means the specific engine rating selected according to section (d)(7.1.1) or (d)(7.2.2)(B) for compliance with section 1971.1.1.

"OBD child rating" means an engine rating (other than the OBD parent rating) within the engine family containing the OBD parent rating selected according to section (d)(7.1.1) or an engine rating within the OBD group(s) defined according to section (d)(7.2.1) and subject to section (d)(7.2.3).

"Evaporative emission standards" are a subset of emission standards that refer to the specific motor vehicle fuel evaporative emission standards and test procedures incorporated by reference in title 13, CCR section 1976 to which the engine is certified.

"Exhaust emission standards" or "tailpipe emission standards" are a subset of emission standards that collectively refer to the specific FTP standards and SET standards to which an engine is certified.

"Engine misfire" means lack of combustion in the cylinder due to absence of spark, poor fuel metering, poor compression, or any other cause. This does not include lack of combustion events in non-active cylinders due to default fuel shut-off or cylinder deactivation strategies.

"Engine start" is defined as the point when the engine reaches a speed 150 rpm below the normal, warmed-up idle speed (as determined in the drive position for vehicles equipped with an automatic transmission). For hybrid vehicles or for engines employing alternate engine start hardware or strategies (e.g., integrated starter and generators), the manufacturer may request Executive Officer approval to use an alternate definition for engine start (e.g., ignition key "on"). Executive Officer approval of the alternate definition shall be based on equivalence to an engine start for a conventional vehicle.

"Family Emission Limit (FEL)" refers to the exhaust emission levels to which an engine family is certified under the averaging, banking, and trading program incorporated by reference in title 13, CCR section 1956.8.

"Fault memory" means information pertaining to malfunctions stored in the onboard computer, including fault codes, stored engine conditions, and MIL status.

"Federal Test Procedure (FTP) test" refers to an exhaust emission test conducted according to the test procedures incorporated by reference in title 13, CCR section 1956.8(b) and (d) that is used to determine compliance with the FTP standard to which an engine is certified.

"FTP cycle". For engines certified on an engine dynamometer, FTP cycle refers to the engine dynamometer schedule in 40 CFR appendix 1 of part 86, section (f)(1), entitled, "EPA Engine Dynamometer Schedule for Heavy-Duty

Otto-Cycle Engines," or section (f)(2), entitled, "EPA Engine Dynamometer Schedule for Heavy-Duty Diesel Engines."

"FTP standard" refers to the certification exhaust emission standards and test procedures applicable to the FTP cycle incorporated by reference in title 13, CCR sections 1956.8(b) and (d) to which the engine is certified.

"Fuel trim" refers to feedback adjustments to the base fuel schedule. Short-term fuel trim refers to dynamic or instantaneous adjustments. Long-term fuel trim refers to much more gradual adjustments to the fuel calibration schedule than short-term trim adjustments.

"Fueled engine operation" is the state where any fuel is introduced into the engine for the purposes of combustion.

"Functional check" for an output component or system means verification of proper response of the component and system to a computer command.

"Gasoline engine" refers to an Otto-cycle engine.

"Heavy-duty engine" means an engine that is used to propel a heavy-duty vehicle.

"Heavy-duty vehicle" means any motor vehicle having a manufacturer's gross vehicle weight rating (GVWR) greater than 14,000 pounds.

"Hybrid vehicle" refers to a vehicle that has both of the following on-vehicle sources of stored energy and can draw propulsion energy from the source mentioned in 2): 1) a consumable fuel and 2) an energy storage device such as a battery, capacitor, pressure reservoir, or flywheel.

"Ignition Cycle" means a driving cycle that begins with engine start, meets the engine start definition for at least two seconds plus or minus one second, and ends with engine shutoff. For hybrid vehicles, "ignition cycle" means a driving cycle that begins when the propulsion system active definition is met for at least two seconds plus or minus one second, and ends when the propulsion system active definition is no longer met.

"Keep-alive memory (KAM)," for the purposes of this regulation, is defined as a type of memory that retains its contents as long as power is provided to the on-board control unit. KAM is not erased upon shutting off the engine but may be erased if power to the on-board control unit is interrupted (e.g., vehicle battery disconnected, fuse to control unit removed). In some cases, portions of KAM may be erased with a scan tool command to reset KAM.

"Key on, engine off position" refers to a vehicle with the ignition key in the engine run position (not engine crank or accessory position) but with the engine not running.

"Malfunction" means any deterioration or failure of a component or system that causes the performance to be outside of the applicable limits in sections (e) through (g).

"Manufacturer" for the purpose of this regulation means the holder of the Executive Order for the engine family.

"MIL-on fault code," for purposes of engines using SAE J1939, refers to the diagnostic trouble code stored when an OBD system has confirmed that a malfunction exists (e.g., typically on the second driving cycle that the malfunction is detected) and has commanded the MIL on in accordance with the requirements of sections (d)(2), (e), (g), and (h)(4.4).

"Non-volatile random access memory (NVRAM)," for the purposes of this regulation, is defined as a type of memory that retains its contents even when power to the on-board control unit is interrupted (e.g., vehicle battery disconnected, fuse to control unit removed). NVRAM is typically made non-volatile either by use of a back-up battery within the control unit or through the use of an electrically erasable and programmable read-only memory (EEPROM) chip.

"Not-To-Exceed (NTE) control area" refers to the bounded region of the engine's torque and speed map, as defined in 40 CFR 86.1370-2007, where emissions must not exceed a specific emission cap for a given pollutant under the NTE requirement.

"Manufacturer-specific NOx NTE carve-out area" refers to regions within the NTE control area for NOx where the manufacturer has limited NTE testing as allowed by 40 CFR 86.1370-2007(b)(7).

"Manufacturer-specific PM NTE carve-out area" refers to regions within the NTE control area for PM where the manufacturer has limited NTE testing as allowed by 40 CFR 86.1370-2007(b)(7).

"NTE deficiency" refers to regions or conditions within the NTE control area for NOx or PM where the manufacturer has received a deficiency as allowed by 40 CFR 86.007-11(a)(4)(iv).

"OBD group" refers to a combination of engines, engine families, or engine ratings that use the same OBD strategies and similar calibrations. A manufacturer is required to submit a grouping plan for Executive Officer review and approval detailing the OBD groups and the engine families and engine ratings within each group for a model year.

"Pending fault code" is defined as the diagnostic trouble code stored upon the initial detection of a malfunction (e.g., typically on a single driving cycle) prior to illumination of the MIL in accordance with the requirements of sections (d)(2), (e) through (g), and (h)(4.4).

"Permanent fault code" is defined as a confirmed or MIL-on fault code that is stored in NVRAM as specified in sections (d)(2) and (h)(4.4).

"Percentage of misfire" as used in sections (e)(2) and (f)(2) means the percentage of misfires out of the total number of firing events for the specified interval.

"Power Take-Off (PTO) unit" refers to an engine driven output provision for the purposes of powering auxiliary equipment (e.g., a dump-truck bed, aerial bucket, or tow-truck winch).

"Previously MIL-on fault code," for purposes of engines using SAE J1939, is defined as the diagnostic trouble code stored when an OBD system has confirmed that a malfunction no longer exists (e.g., after the third consecutive driving cycle in which the corresponding monitor runs and the malfunction is not detected), extinguishes the MIL, and erases the corresponding MIL-on fault code in accordance with the requirements of sections (d)(2), (e), (g), and (h)(4.4).

"Propulsion system active" is the state where the powertrain (e.g., engine, electric machine) is enabled by the driver (e.g., after ignition on for conventional vehicles, after power button pushed for some hybrid vehicles) such that the vehicle is ready to be used (e.g., vehicle is ready to be driven, ready to be shifted from "park" to "drive"). For purposes of this definition, "the state where the powertrain is enabled" does not include activations that are not driver-initiated (e.g., conditions where portions of the vehicle system wake up to perform OBD monitoring).

"Rationality fault diagnostic" for an input component means verification of the accuracy of the input signal while in the range of normal operation and when compared to all other available information.

"Redline engine speed" shall be defined by the manufacturer as either the recommended maximum engine speed as normally displayed on instrument panel tachometers or the engine speed at which fuel shutoff occurs.

"Response rate" for exhaust gas sensors refers to the delay from when the sensor is exposed to a different make-up of exhaust gas constituents until it outputs a signal reflecting the different make-up of exhaust gas constituents. For example, for oxygen sensors, response rate is the delay from when the oxygen sensor is exposed to a change in exhaust gas from richer/leaner than stoichiometric to leaner/richer than stoichiometric to the time when the oxygen sensor indicates the lean/rich condition. Similarly, for wide-range air-fuel (A/F) sensors, response rate is the delay from when the sensor is exposed to a different A/F ratio to the time it indicates the different A/F ratio. For NOx and PM sensors, response rate is the delay from when the sensor is exposed to a different NOx or PM exhaust gas level until it indicates the different NOx or PM exhaust gas level.

"Secondary air" refers to air introduced into the exhaust system by means of a pump or aspirator valve or other means that is intended to aid in the oxidation of HC and CO contained in the exhaust gas stream.

"Similar conditions" as used in sections (e)(1), (e)(2), (f)(1), and (f)(2) means engine conditions having an engine speed within 375 rpm, load conditions within 20 percent, and the same warm-up status (i.e., cold or hot) as the engine conditions stored pursuant to (e)(1.4.2)(E), (e)(2.4.2)(C), (f)(1.4.5), and (f)(2.4.4). The Executive Officer may approve other definitions of similar conditions based on comparable timeliness and reliability in detecting similar engine operation.

"Small volume manufacturer" is defined in title 13, CCR section 1900(b), with the exception that California sales of less than 1200 heavy-duty engines will be used in lieu of 4500 heavy-duty engines.

"Start of production" is the time when the manufacturer has produced two percent of the projected volume for the engine or vehicle, whichever is specified in sections (k) and (l).

"Supplemental Emission Test (SET) cycle" refers to the driving schedule defined as the "supplemental steady state emission test" in 40 CFR 86.1360-2007.

"SET standard" refers to the certification exhaust emission standards and test procedures applicable to the SET cycle incorporated by reference in title 13, CCR sections 1956.8(b) and (d) to which the engine is certified.

"Warm-up cycle" means a driving cycle with sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine start and reaches a minimum temperature of at least 160 degrees Fahrenheit (140 degrees Fahrenheit for applications with diesel engines). Alternatively, manufacturers may define warm-up cycle as a driving cycle with vehicle operation in which the following criteria are met: for vehicles using the ISO 15765-4 protocol, the manufacturers may use the criteria specified in sections (d)(2.3.1)(C)(ii)b.3.i., ii., and iii. herein, and for vehicles using the SAE J1939 protocol, the manufacturer may use the criteria specified in sections (d)(2.3.2)(D)(ii)b.3.i., ii., and iii. herein.

"Weighted sales number" means a manufacturer's projected sales number for engines to be used in California heavy-duty vehicles multiplied by a weight class factor. Sales numbers for diesel engines for heavy-duty vehicles less than 19,499 pounds GVWR shall be multiplied by 1.0. Sales numbers for diesel engines for heavy-duty vehicles from 19,500 to 33,000 pounds shall be multiplied by 1.68. Sales numbers for diesel engines for heavy-duty vehicles greater than 33,000 pounds and urban buses shall be multiplied by 3.95. Sales numbers for all gasoline engines for heavy-duty vehicles shall be multiplied by 1.0.

(d) *General Requirements.*

Section (d) sets forth the general requirements of the OBD system. Specific performance requirements for components and systems that shall be monitored are set forth in sections (e) through (g) below. The OBD system is required to detect all malfunctions specified in sections (e) through (g). However, except as specified elsewhere, the OBD system is not required to use a unique monitor to detect each malfunction specified.

(1) The OBD System.

(1.1) If a malfunction is present as specified in sections (e) through (g), the OBD system shall detect the malfunction, store a pending, confirmed, MIL-on, or previously MIL-on fault code in the onboard computer's memory, and illuminate the MIL as required.

(1.2) The OBD system shall be equipped with a standardized data link connector to provide access to the stored fault codes as specified in section (h).

(1.3) The OBD system shall be designed to operate, without any required scheduled maintenance, for the actual life of the engine in which it is installed and may not be programmed or otherwise designed to deactivate based on age and/or mileage of the vehicle during the actual life of the engine. This section is not intended to alter existing law and enforcement practice regarding a manufacturer's liability for an engine beyond its useful life, except where an engine has been programmed or otherwise designed so that an OBD system deactivates based on age and/or mileage of the engine.

(1.4) Computer-coded engine operating parameters may not be changeable without the use of specialized tools and procedures (e.g. soldered or potted computer components or sealed (or soldered) computer enclosures). Subject to Executive Officer approval, manufacturers may exempt from this requirement those product lines that are unlikely to require protection. Criteria to be evaluated in making an exemption include current availability of performance chips, performance capability of the engine, and sales volume.

(2) MIL and Fault Code Requirements.

(2.1) MIL Specifications.

(2.1.1) The MIL shall be located on the driver's side instrument panel and be of sufficient illumination and location to be readily visible under all lighting conditions and shall be amber in color when illuminated. The MIL, when illuminated, shall display the International Standards Organization (ISO) engine symbol. There shall be only one MIL used to indicate all faults detected by the OBD system on a single vehicle.

(2.1.2) The MIL shall illuminate in the key on, engine off position before engine cranking to indicate that the MIL is functional. The MIL shall continuously illuminate during this functional check for a minimum of 15 seconds. During this functional check of the MIL, the data stream value for MIL status shall indicate commanded off (see section (h)(4.2)) unless the MIL has also been commanded on for a detected malfunction. This functional check of the MIL is not required during vehicle operation in the key on, engine off position subsequent to the initial engine cranking of an ignition cycle (e.g., due to an engine stall or other non-commanded engine shutoff).

(2.1.3) At the manufacturer's option, the MIL may be used to indicate readiness status in a standardized format (see section (h)(4.1.6)) in the key on, engine off position.

(2.1.4) A manufacturer may request Executive Officer approval to also use the MIL to indicate which, if any, fault codes are currently stored (e.g., to "blink" the stored codes). The Executive Officer shall approve the request upon determining that the manufacturer has demonstrated that the method used

to indicate the fault codes will not be unintentionally activated during a California inspection test or during routine driver operation.

(2.1.5) The MIL may not be used for any purpose other than specified in this regulation.

(2.2). MIL Illumination and Fault Code Storage Protocol.

(2.2.1) For vehicles using the ISO 15765-4 protocol for the standardized functions required in section (h):

(A) Upon detection of a malfunction, the OBD system shall store a pending fault code within 10 seconds indicating the likely area of the malfunction.

(B) After storage of a pending fault code, if the identified malfunction is again detected before the end of the next driving cycle in which monitoring occurs, the OBD system shall illuminate the MIL continuously, keep the pending fault code stored, and store a confirmed fault code within 10 seconds. If a malfunction is not detected before the end of the next driving cycle in which monitoring occurs (i.e., there is no indication of the malfunction at any time during the driving cycle), the corresponding pending fault code set according to section (d)(2.2.1)(A) shall be erased at the end of the driving cycle.

(C) A manufacturer may request Executive Officer approval to employ alternate statistical MIL illumination and fault code storage protocols to those specified in these requirements. The Executive Officer shall grant approval upon determining that the manufacturer has provided data and/or engineering evaluation that demonstrate that the alternative protocols can evaluate system performance and detect malfunctions in a manner that is equally effective and timely. Strategies requiring on average more than six driving cycles for MIL illumination may not be accepted.

(D) Storage and erasure of freeze frame conditions.

(i) The OBD system shall store and erase "freeze frame" conditions (as defined in section (h)(4.3)) present at the time a malfunction is detected.

(ii) For 2010 through 2015 model year engines, the OBD system shall store and erase freeze frame conditions in conjunction with the storage and erasure of either pending or confirmed fault codes as required elsewhere in section (d)(2.2).

(iii) For 2016 and subsequent model year engines, except as provided for in section (d)(2.2.1)(D)(iv), the OBD system shall store freeze frame conditions in conjunction with the storage of a pending fault code.

a. If the pending fault code is erased in the next driving cycle in which monitoring occurs and a malfunction is not detected (as described in section (d)(2.2.1)(B)), the OBD system may erase the corresponding freeze frame conditions.

b. If the pending fault code matures to a confirmed fault code (as described in section (d)(2.2.1)(B)), the OBD system shall either retain the currently stored freeze frame conditions or replace the stored freeze frame conditions with freeze frame conditions regarding the confirmed fault code. The OBD system shall erase the freeze frame information in conjunction with the erasure of the confirmed fault code (as described under section (d)(2.3.1)(B)).

(iv) For alternate strategies that do not store pending fault codes (i.e., monitors using alternate statistical strategies described in section (d)(2.2.1)(C) such as monitors that store a confirmed fault code and illuminate the MIL upon the first detection of a malfunction), the OBD system shall store and erase freeze frame conditions in conjunction with the storage and erasure of the confirmed fault code.

(E) The OBD system shall illuminate the MIL and store a confirmed fault code within 10 seconds to inform the vehicle operator whenever the engine enters a default or "limp home" mode of operation that can affect emissions or the performance of the OBD system or in the event of a malfunction of an on-board computer(s) itself that can affect the performance of the OBD system. If the default or "limp home" mode of operation is recoverable (i.e., the diagnostic or control strategy that caused the default or "limp home" mode of operation can run on the next driving cycle and confirm the presence of the condition that caused the default or "limp home" operation), the OBD system may, in lieu of illuminating the MIL within 10 seconds on the first driving cycle where the default or "limp home" mode of operation is entered, delay illumination of the MIL until the condition causing the default or "limp home" mode of operation is again detected before the end of the next driving cycle.

(F) Before the end of an ignition cycle, the OBD system shall store confirmed fault codes that are currently causing the MIL to be illuminated in NVRAM as permanent fault codes (as defined in section (h)(4.4.1)(F)).

(2.2.2) For vehicles using the SAE J1939 protocol for the standardized functions required in section (h):

(A) Upon detection of a malfunction, the OBD system shall store a pending fault code within 10 seconds indicating the likely area of the malfunction.

(B) After storage of a pending fault code, if the identified malfunction is again detected before the end of the next driving cycle in which monitoring occurs, the OBD system shall illuminate the MIL continuously, erase the pending fault code, and store a MIL-on fault code within 10 seconds. If a malfunction is not detected before the end of the next driving cycle in which monitoring occurs (i.e., there is no indication of the malfunction at any time during the driving cycle), the corresponding pending fault code set according to section (d)(2.2.2)(A) shall be erased at the end of the driving cycle.

(C) A manufacturer may request Executive Officer approval to employ alternate statistical MIL illumination and fault code storage protocols to those specified in these requirements. The Executive Officer shall grant approval upon determining that the manufacturer has provided data and/or engineering evaluation that demonstrate that the alternative protocols can evaluate system performance and detect malfunctions in a manner that is equally effective and timely. Strategies requiring on average more than six driving cycles for MIL illumination may not be accepted.

(D) Storage and erasure of freeze frame conditions.

(i) The OBD system shall store and erase "freeze frame" conditions (as defined in section (h)(4.3)) present at the time a malfunction is detected.

(ii) The OBD system shall store freeze frame conditions in conjunction with the storage of a pending fault code.

(iii) If the pending fault code is erased in the next driving cycle in which monitoring occurs and a malfunction is not detected (as described under section (d)(2.2.2)(B)), the OBD system may erase the corresponding freeze frame conditions.

(iv) If the pending fault code matures to a MIL-on fault code (as described under section (d)(2.2.2)(B)), the OBD system shall either retain the currently stored freeze frame conditions or replace the stored freeze frame conditions with freeze frame conditions regarding the MIL-on fault code. The OBD system shall erase the freeze frame information in conjunction with the erasure of the previously MIL-on fault code (as described under section (d)(2.3.2)(C)).

(v) For alternate strategies that do not store pending fault codes (i.e., monitors using alternate statistical strategies described in section (d)(2.2.1)(C) such as monitors that store a MIL-on fault code and illuminate the MIL upon the first detection of a malfunction), the OBD system shall store and erase freeze frame conditions in conjunction with the storage and erasure of the MIL-on fault code.

(E) The OBD system shall illuminate the MIL and store a MIL-on fault code within 10 seconds to inform the vehicle operator whenever the engine enters a default or "limp home" mode of operation that can affect emissions or the performance of the OBD system or in the event of a malfunction of an on-board computer(s) itself that can affect the performance of the OBD system. If the default or "limp home" mode of operation is recoverable (i.e., the diagnostic or control strategy that caused the default or "limp home" mode of operation can run on the next driving cycle and confirm the presence of the condition that caused the default or "limp home" operation), the OBD system may, in lieu of illuminating the MIL within 10 seconds on the first driving cycle where the default or "limp home" mode of operation is entered, delay illumination of the MIL until the condition causing the default

or "limp home" mode of operation is again detected before the end of the next driving cycle.

(F) Before the end of an ignition cycle, the OBD system shall store MIL-on fault codes that are currently causing the MIL to be illuminated in NVRAM as permanent fault codes (as defined in section (h)(4.4.2)(F)).

(2.3) MIL Extinguishing and Fault Code Erasure Protocol.

(2.3.1) For vehicles using the ISO 15765-4 protocol for the standardized functions required in section (h):

(A) Extinguishing the MIL. Except as otherwise provided in sections (e)(1.4.2)(F), (e)(2.4.2)(D), (e)(6.4.2), (f)(1.4.6), (f)(2.4.5), and (f)(7.4.2) (for diesel fuel system, diesel misfire, diesel empty reductant tank, gasoline fuel system, gasoline misfire, and gasoline evaporative system malfunctions), once the MIL has been illuminated, it shall be extinguished after at least three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions and the previously detected malfunction is no longer present provided no other malfunction has been detected that would independently illuminate the MIL according to the requirements outlined above.

(B) Erasing a confirmed fault code. For 2010 through 2015 model year engines, the OBD system may erase a confirmed fault code if the identified malfunction has not been again detected in at least 40 warm-up cycles and the MIL is presently not illuminated for that malfunction. For 2016 and subsequent model year engines, the OBD system shall erase a confirmed fault code if the identified malfunction has not been again detected in 40 warm-up cycles and the MIL is presently not illuminated for that malfunction.

(C) Erasing a permanent fault code.

(i) If the OBD system is commanding the MIL on, the OBD system shall erase a permanent fault code only if the OBD system itself determines that the malfunction that caused the permanent fault code to be stored is no longer present and is not commanding the MIL on, pursuant to the requirements of section (d)(2.3.1)(A) (which for the purposes of this section shall apply to all monitors). Erasure of the permanent fault code shall occur in conjunction with extinguishing the MIL or no later than the start of the first drive cycle that begins with the MIL commanded off.

(ii) If all fault information in the on-board computer other than the permanent fault code has been cleared (i.e., through the use of a scan tool or battery disconnect) and the OBD system is not commanding the MIL on:

a. Except as provided for in section (d)(2.3.1)(C)(ii)c., if the monitor of the malfunction that caused the permanent fault code to be stored is

subject to the minimum ratio requirements of section (d)(3.2) (e.g., catalyst monitor, comprehensive component input component rationality monitors), the OBD system shall erase the permanent fault code at the end of a driving cycle if the monitor has run and made one or more determinations during a driving cycle that the malfunction of the component or the system is not present and has not made any determinations within the same driving cycle that the malfunction is present.

b. If the monitor of the malfunction that caused the permanent fault code to be stored is not subject to the minimum ratio requirements of section (d)(3.2) (e.g., gasoline misfire monitor, gasoline fuel system monitor, comprehensive component circuit continuity monitors), the OBD system shall erase the permanent fault code at the end of a driving cycle if:

1. The monitor has run and made one or more determinations during a driving cycle that the malfunction of the component or the system is not present and has not made any determinations within the same driving cycle that the malfunction is present;

2. The monitor has not made any determinations that the malfunction is present subsequent to the most recent driving cycle in which the criteria of section (d)(2.3.1)(C)(ii)b.1. are met; and

3. The following criteria are satisfied on any single driving cycle (which may be a different driving cycle than that in which the criteria of section (d)(2.3.1)(C)(ii)b.1. are satisfied):

i. Except as provided in section (d)(2.3.1)(C)(ii)b.3.v. below, cumulative time since engine start is greater than or equal to 600 seconds;

ii. Cumulative gasoline engine operation at or above 25 miles per hour or diesel engine operation at or above 1150 rpm, either of which occurs for greater than or equal to 300 seconds;

iii. Continuous vehicle operation at idle (i.e., accelerator pedal released by driver and either vehicle speed less than or equal to one mile per hour or engine speed less than or equal to 200 rpm above normal warmed-up idle (as determined in the drive position for vehicles equipped with an automatic transmission)) for greater than or equal to 30 seconds; and

iv. The monitor has not made any determinations that the malfunction is present.

v. For hybrid vehicles, manufacturers shall use "cumulative propulsion system active time" in lieu of "cumulative time

since engine start" for the criterion in section (d)(2.3.1)(C)(ii)b.3.i.

4. Monitors required to use "similar conditions" as defined in section (c) to store and erase pending and confirmed fault codes may not require that the similar conditions be met prior to erasure of the permanent fault code.

c. For monitors subject to section (d)(2.3.1)(C)(ii)a., the manufacturer may choose to erase the permanent fault code using the criteria under section (d)(2.3.1)(C)(ii)b. in lieu of the criteria under section (d)(2.3.1)(C)(ii)a.

d. For 2010 through 2012 model year engines, manufacturers may request Executive Officer approval to use alternate criteria to erase the permanent fault code. The Executive Officer shall approve alternate criteria that will not likely require driving conditions that are longer and more difficult to meet than those required under section (d)(2.3.1)(C)(ii)b.

(2.3.2) For vehicles using the SAE J1939 protocol for the standardized functions required in section (h):

(A) Extinguishing the MIL. Except as otherwise provided in sections (e)(1.4.2)(F), (e)(2.4.2)(D) and (e)(6.4.2) for fuel system malfunctions, misfire malfunctions, and empty reductant tanks, once the MIL has been illuminated, it shall be extinguished after at least three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions and the previously detected malfunction is no longer present provided no other malfunction has been detected that would independently illuminate the MIL according to the requirements outlined above.

(B) Erasing a MIL-on fault code. The OBD system may erase a MIL-on fault code in conjunction with extinguishing the MIL as described under section (d)(2.3.2)(A). In addition to the erasure of the MIL-on fault code, the OBD system shall store a previously MIL-on fault code for that failure.

(C) Erasing a previously MIL-on fault code. For 2010 through 2015 model year engines, the OBD system may erase a previously MIL-on fault code if the identified malfunction has not been again detected in at least 40 warm-up cycles and the MIL is presently not illuminated for that malfunction. For 2016 and subsequent model year engines, the OBD system shall erase a previously MIL-on fault code if the identified malfunction has not been again detected in 40 warm-up cycles and the MIL is presently not illuminated for that malfunction.

(D) Erasing a permanent fault code. The OBD system shall erase a permanent fault code under the following conditions:

(i) If the OBD system is commanding the MIL on, the OBD system shall erase a permanent fault code only if the OBD system itself determines that the malfunction that caused the permanent fault code to be stored is no longer present and is not commanding the MIL on, pursuant to the requirements of section (d)(2.3.2)(A) (which for the purposes of this section shall apply to all monitors). Erasure of the permanent fault code shall occur in conjunction with extinguishing the MIL or no later than the start of the first drive cycle that begins with the MIL commanded off.

(ii) If all fault information in the on-board computer has been cleared (i.e., through the use of a scan tool or battery disconnect) and the OBD system is not commanding the MIL on:

a. Except as provided for in section (d)(2.3.2)(D)(ii)c., if the monitor of the malfunction that caused the permanent fault code to be stored is subject to the minimum ratio requirements of section (d)(3.2) (e.g., catalyst monitor, comprehensive component input component rationality monitors), the OBD system shall erase the permanent fault code at the end of a driving cycle if the monitor has run and made one or more determinations during a driving cycle that the malfunction of the component or the system is not present and has not made any determinations within the same driving cycle that the malfunction is present.

b. If the monitor of the malfunction that caused the permanent fault code to be stored is not subject to the minimum ratio requirements of section (d)(3.2) (e.g., continuous diesel fuel system monitors, comprehensive component circuit continuity monitors), the OBD system shall erase the permanent fault code at the end of a driving cycle if:

1. The monitor has run and made one or more determinations during a driving cycle that the malfunction of the component or the system is not present and has not made any determinations within the same driving cycle that the malfunction is present;

2. The monitor has not made any determinations that the malfunction is present subsequent to the most recent driving cycle in which the criteria of section (d)(2.3.2)(D)(ii)b.1. are met; and

3. The following criteria are satisfied on any single driving cycle (which may be a different driving cycle than that in which the criteria of section (d)(2.3.2)(D)(ii)b.1. are satisfied):

i. Except as provided in section (d)(2.3.2)(D)(ii)b.3.v. below, cumulative time since engine start is greater than or equal to 600 seconds;

ii. Cumulative gasoline engine operation at or above 25 miles per hour or diesel engine operation at or above 1150 rpm, either of which occurs for greater than or equal to 300 seconds;

iii. Continuous vehicle operation at idle (i.e., accelerator pedal released by driver and either vehicle speed less than or equal to one mile per hour or engine speed less than or equal to 200 rpm above normal warmed-up idle (as determined in the drive position for vehicles equipped with an automatic transmission)) for greater than or equal to 30 seconds; and

iv. The monitor has not made any determinations that the malfunction is present.

v. For hybrid vehicles, manufacturers shall use "cumulative propulsion system active time" in lieu of "cumulative time since engine start" for the criterion in section (d)(2.3.2)(D)(ii)b.3.i.

4. Monitors required to use "similar conditions" as defined in section (c) to store and erase pending and confirmed/MIL-on fault codes may not require that the similar conditions be met prior to erasure of the permanent fault code.

c. For monitors subject to section (d)(2.3.2)(D)(ii)a., the manufacturer may choose to erase the permanent fault code using the criteria under section (d)(2.3.2)(D)(ii)b. in lieu of the criteria under section (d)(2.3.2)(D)(ii)a.

d. For 2010 through 2012 model year engines, manufacturers may request Executive Officer approval to use alternate criteria to erase the permanent fault code. The Executive Officer shall approve alternate criteria that will not likely require driving conditions that are longer and more difficult to meet than those required under section (d)(2.3.2)(D)(ii)b.

(2.4) Exceptions to MIL and Fault Code Requirements.

(2.4.1) If the engine enters a default mode of operation, a manufacturer may request Executive Officer approval to be exempt from illuminating the MIL. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or engineering evaluation that verify either of the following:

(A) The default strategy (1) causes an overt indication (e.g., illumination of a red engine shut-down warning light) such that the driver is certain to respond and have the problem corrected, (2) is not caused by a component required to be monitored by the OBD system under sections (e) through (g), and (3) is not invoked to protect a component required to be monitored by the OBD system under sections (e) through (g); or

(B) The default strategy is an AECD that is properly activated due to the occurrence of conditions that have been approved by the Executive Officer.

(2.4.2) For gasoline engines, a manufacturer may elect to meet the MIL and fault code requirements in title 13, CCR section 1968.2.1(d)(2) in lieu of meeting the requirements of (d)(2).

(3) Monitoring Conditions.

Section (d)(3) sets forth the general monitoring requirements while sections (e) through (g) sets forth the specific monitoring requirements as well as identifies which of the following general monitoring requirements in section (d)(3) are applicable for each monitored component or system identified in sections (e) through (g).

(3.1) For all engines:

(3.1.1) As specifically provided for in sections (e) through (g), manufacturers shall define monitoring conditions, subject to Executive Officer approval, for detecting malfunctions identified in sections (e) through (g). The Executive Officer shall approve manufacturer-defined monitoring conditions that are determined (based on manufacturer-submitted data and/or other engineering documentation) to be: technically necessary to ensure robust detection of malfunctions (e.g., avoid false passes and false indications of malfunctions); designed to ensure monitoring will occur under conditions that may reasonably be expected to be encountered in normal vehicle operation and use; and designed to ensure monitoring will occur during the FTP cycle.

(3.1.2) Monitoring shall occur at least once per driving cycle in which the monitoring conditions are met.

(3.1.3) Manufacturers may request Executive Officer approval to define monitoring conditions that are not encountered during the FTP cycle as required in section (d)(3.1.1). In evaluating the manufacturer's request, the Executive Officer shall consider the degree to which the requirement to run during the FTP cycle restricts in-use monitoring, the technical necessity for defining monitoring conditions that are not encountered during the FTP cycle, data and/or an engineering evaluation submitted by the manufacturer which demonstrate that the component/system does not normally function, or monitoring is otherwise not feasible, during the FTP cycle, and, where applicable in section (d)(3.2), the ability of the manufacturer to demonstrate the monitoring conditions will satisfy the minimum acceptable in-use monitor performance ratio requirement as defined in section (d)(3.2) (e.g., data which show in-use driving meets the minimum requirements).

(3.2) As specifically provided for in sections (e) through (g), manufacturers shall define monitoring conditions in accordance with the criteria in sections (d)(3.2.1) through (3.2.3).

(3.2.1) Manufacturers shall implement software algorithms in the OBD system to individually track and report in-use performance of the following monitors in the standardized format specified in section (d)(5):

(A) NMHC converting catalyst (section (e)(5.3.1))

(B) NOx converting catalyst (section (e)(6.3.1))

(C) Catalyst (section (f)(6.3));

(D) Exhaust gas sensor (sections (e)(9.3.1)(A) or (f)(8.3.1)(A));

(E) Evaporative system (section (f)(7.3.2));

(F) EGR system (sections (e)(3.3.2) and (3.3.3) or (f)(3.3.1)) and VVT system (sections (e)(10.3) or (f)(9.3));

(G) Secondary air system (section (f)(5.3.1));

(H) PM filter (section (e)(8.3));

(I) Boost pressure control system (sections (e)(4.3.2) and (e)(4.3.3));

(J) NOx adsorber (section (e)(7.3.1));

(K) Fuel system (section (e)(1.3.3)); and

(L) Secondary oxygen sensor (section (f)(8.3.2)(A)).

The OBD system is not required to track and report in-use performance for monitors other than those specifically identified above.

(3.2.2) For all 2013 and subsequent model year engines, manufacturers shall define monitoring conditions that, in addition to meeting the criteria in sections (d)(3.1) and (d)(3.2.1), ensure that the monitor yields an in-use performance ratio (as defined in section (d)(4)) that meets or exceeds the minimum acceptable in-use monitor performance ratio for in-use vehicles. For purposes of this regulation, the minimum acceptable in-use monitor performance ratio is 0.100 for all monitors specifically required in sections (e) through (g) to meet the monitoring condition requirements of section (d)(3.2).

(3.2.3) Manufacturers may not use the calculated ratio (or any element thereof) or any other indication of monitor frequency as a monitoring condition for a monitor (e.g., using a low ratio to enable more frequent monitoring through diagnostic executive priority or modification of other monitoring conditions, or using a high ratio to enable less frequent monitoring).

(3.2.4) Upon request of a manufacturer or upon the best engineering judgment of ARB, the Executive Officer may revise the minimum acceptable in-use monitoring performance ratio specified in section (d)(3.2.2) for a specific monitor if the most reliable monitoring method developed requires a lower ratio.

(4) In-Use Monitor Performance Ratio Definition.

(4.1) For monitors required to meet the requirements in section (d)(3.2), the ratio shall be calculated in accordance with the following specifications for the numerator, denominator, and ratio.

(4.2) Numerator Specifications

(4.2.1) Definition: The numerator is defined as a measure of the number of times a vehicle has been operated such that all monitoring conditions necessary for a specific monitor to detect a malfunction have been encountered.

(4.2.2) Specifications for incrementing:

(A) Except as provided for in section (d)(4.2.2)(E), the numerator, when incremented, shall be incremented by an integer of one. The numerator may not be incremented more than once per driving cycle.

(B) The numerator for a specific monitor shall be incremented within 10 seconds if and only if the following criteria are satisfied on a single driving cycle:

(i) Every monitoring condition necessary for the monitor of the specific component to detect a malfunction and store a pending fault code has been satisfied, including enable criteria, presence or absence of related fault codes, sufficient length of monitoring time, and diagnostic executive priority assignments (e.g., diagnostic "A" must execute prior to diagnostic "B"). For the purpose of incrementing the numerator, satisfying all the monitoring conditions necessary for a monitor to determine the component is passing may not, by itself, be sufficient to meet this criteria.

(ii) For monitors that require multiple stages or events in a single driving cycle to detect a malfunction, every monitoring condition necessary for all events to have completed must be satisfied.

(iii) For monitors that require intrusive operation of components to detect a malfunction, a manufacturer shall request Executive Officer approval of the strategy used to determine that, had a malfunction been present, the monitor would have detected the malfunction. Executive Officer approval of the request shall be based on the equivalence of the strategy to actual intrusive operation and the ability of the strategy to accurately determine if every monitoring condition necessary for the intrusive event to occur was satisfied.

(iv) For the secondary air system monitor, the criteria in sections (d)(4.2.2)(B)(i) through (iii) above are satisfied during normal operation of the secondary air system. Monitoring during intrusive operation of the secondary air system later in the same driving cycle solely for the purpose of monitoring may not, by itself, be sufficient to meet this criteria.

(C) For monitors that can generate results in a "gray zone" or "non-detection zone" (i.e., results that indicate neither a passing system nor a malfunctioning system) or in a "non-decision zone" (e.g., monitors that increment and decrement counters until a pass or fail threshold is reached), the manufacturer shall submit a plan for appropriate incrementing of the numerator to the Executive Officer for review and approval. In general, the Executive Officer shall not approve plans that allow the numerator to be incremented when the monitor indicates a result in the "non-detection zone" or prior to the monitor reaching a decision. In reviewing the plan for approval, the Executive Officer shall consider data and/or engineering evaluation submitted by the manufacturer demonstrating the expected frequency of results in the "non-detection zone" and the ability of the monitor to accurately determine if a monitor would have detected a malfunction instead of a result in the "non-detection zone" had an actual malfunction been present.

(D) For monitors that run or complete during engine-off operation, the numerator shall be incremented within 10 seconds after the monitor has completed during engine-off operation or during the first 10 seconds of engine start on the subsequent driving cycle.

(E) Except as specified in section (d)(4.2.2)(F) for exponentially weighted moving averages, manufacturers utilizing alternate statistical MIL illumination protocols as allowed in sections (d)(2.2.1)(C) and (d)(2.2.2)(C) for any of the monitors requiring a numerator shall submit a plan for appropriate incrementing of the numerator to the Executive Officer for review and approval. Executive Officer approval of the plan shall be conditioned upon the manufacturer providing supporting data and/or engineering evaluation demonstrating the equivalence of the incrementing in the manufacturer's plan to the incrementing specified in section (d)(4.2.2) for monitors using the standard MIL illumination protocol and the overall equivalence of the manufacturer's plan in determining that the minimum acceptable in-use performance ratio in section (d)(3.2) is satisfied.

(F) Manufacturers using an exponentially weighted moving average (EWMA) as the alternate statistical MIL illumination protocol approved in accordance with sections (d)(2.2.1)(C) and (d)(2.2.2)(C) shall increment the numerator as follows:

(i) Following a reset or erasure of the EWMA result, the numerator may not be incremented until after the requisite number of decisions necessary for MIL illumination have been fully executed.

(ii) After the number of decisions required in section (d)(4.2.2)(F)(i) above, the numerator, when incremented, shall be incremented by an integer of one and may not be incremented more than once per driving cycle. Incrementing of the numerator shall also be in accordance with sections (d)(4.2.2)(B), (C), and (D).

(4.3) Denominator Specifications

(4.3.1) Definition: The denominator is defined as a measure of the number of times a vehicle has been operated as defined in (d)(4.3.2).

(4.3.2) Specifications for incrementing:

(A) The denominator, when incremented, shall be incremented by an integer of one. The denominator may not be incremented more than once per driving cycle.

(B) Except as provided for in sections (d)(4.3.2)(F), (I), and (J), the denominator for each monitor shall be incremented within 10 seconds if and only if the following criteria are satisfied on a single driving cycle:

(i) Cumulative time since engine start of driving cycle is greater than or equal to 600 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit;

(ii) Cumulative gasoline engine operation at or above 25 miles per hour or diesel engine operation at or above 1150 rpm, either of which occurs for greater than or equal to 300 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit; and

(iii) Continuous vehicle operation at idle (i.e., accelerator pedal released by driver and either vehicle speed less than or equal to one mile per hour or engine speed less than or equal to 200 rpm above normal warmed-up idle (as determined in the drive position for vehicles equipped with an automatic transmission)) for greater than or equal to 30 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit.

(iv) For 2010 through 2012 model year diesel engines, manufacturers may use diesel engine operation at or above 15% calculated load in lieu of 1150 rpm for the criterion in section (d)(4.3.2)(B)(ii) above.

(C) In addition to the requirements of section (d)(4.3.2)(B) above, for the evaporative system monitor, the comprehensive component input component temperature sensor rationality monitors (section (g)(3)) (e.g., intake air temperature sensor, ambient temperature sensor, fuel temperature sensor), and the engine cooling system input components (section (g)(1)), the denominator(s) shall be incremented if and only if:

(i) Cumulative time since engine start of driving cycle is greater than or equal to 600 seconds while at an ambient temperature of greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit; and

(ii) Engine cold start occurs with engine coolant temperature at engine

start greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit and less than or equal to 12 degrees Fahrenheit higher than ambient temperature at engine start.

(D) In addition to the requirements of section (d)(4.3.2)(B) above, the denominator(s) for the following monitors shall be incremented if and only if the component or strategy is commanded "on" for a cumulative time greater than or equal to 10 seconds:

(i) Secondary Air System (section (f)(5))

(ii) Cold Start Emission Reduction Strategy (sections (e)(11) or (f)(4))

(iii) Components or systems that operate only at engine start-up (e.g., glow plugs, intake air heaters) and are subject to monitoring under "other emission control systems" (section (g)(4)) or comprehensive component output components (section (g)(3))

For purposes of determining this commanded "on" time, the OBD system may not include time during intrusive operation of any of the components or strategies later in the same driving cycle solely for the purposes of monitoring.

(E) In addition to the requirements of section (d)(4.3.2)(B) above, the denominator(s) for the following component monitors (except those operated only at engine start-up and subject to the requirements of the previous section (d)(4.3.2)(D)) shall be incremented if and only if the component is commanded to function (e.g., commanded "on", "open", "closed", "locked") for a cumulative time greater than or equal to 10 seconds:

(i) Variable valve timing and/or control system (sections (e)(10) or (f)(9))

(ii) "Other emission control systems" (section (g)(4))

(iii) Comprehensive component output component (section (g)(3)) (e.g., turbocharger waste-gates, variable length manifold runners)

(iv) PM filter active/intrusive injection (section (e)(8.2.6))

(v) PM sensor heater (section (e)(9.2.4)(A))

As an alternative, in addition to the requirements of section (d)(4.3.2)(B), the manufacturer may use the criteria specified in title 13, CCR section 1968.2.1(d)(4.3.2)(F) in lieu of the criteria specified in section (d)(4.3.2)(E) above.

For the PM filter active/intrusive injection monitor, as an alternative for 2010 through 2015 model year engines, the manufacturer may use the criteria in section (d)(4.3.2)(H) in lieu of the criteria specified in section (d)(4.3.2)(E) above.

For the PM sensor heater monitor, as an alternative for 2010 through 2015 model year engines, the manufacturer may use the criteria specified in section (d)(4.3.2)(B) in lieu of the criteria specified in section (d)(4.3.2)(E) above.

(F) For the following component monitors, the manufacturer may request Executive Officer approval to use alternate or additional criteria to that set forth in section (d)(4.3.2)(B) above for incrementing the denominator. Executive Officer approval of the proposed criteria shall be based on the equivalence of the proposed criteria in measuring the frequency of monitor operation relative to the amount of vehicle operation in accordance with the criteria in section (d)(4.3.2)(B) above:

(i) "Other emission control systems" (section (g)(4))

(ii) Comprehensive component input components that require extended monitoring evaluation (section (g)(3)) (e.g., stuck fuel level sensor rationality)

(iii) PM filter frequent regeneration (section (e)(8.2.2))

(iv) PM sensor monitoring capability monitor (section (e)(9.2.2)(D))

(G) For the following monitors of components or other emission controls that experience infrequent regeneration events, the denominator(s) shall be incremented during a driving cycle in which the following two criteria are met: (1) the requirements of section (d)(4.3.2)(B) are met on the current driving cycle, and (2) the number of minutes of cumulative engine run time since the denominator was last incremented is greater than or equal to 800 minutes. The 800-minute engine run time counter shall be reset to zero and begin counting again after the denominator has been incremented and no later than the start of the next ignition cycle:

(i) Diesel NMHC converting catalyst (section (e)(5.2.2))

(ii) Diesel NMHC converting catalyst other aftertreatment assistance functions (sections (e)(5.2.3)(B) and (D))

(iii) Catalyzed PM filter NMHC conversion (section (e)(8.2.4))

(iv) 2010 through 2015 model year PM filter filtering performance and missing substrate (sections (e)(8.2.1) and (8.2.5))

As an alternative, for 2010 through 2012 model year engines, the manufacturer may request Executive Officer approval to use alternate or additional criteria to that set forth in section (d)(4.3.2)(G) above for incrementing the denominator. Executive Officer approval of the proposed criteria shall be based on the effectiveness of the proposed criteria in measuring the frequency of monitor operation relative to the amount of vehicle operation.

(H) For 2013 and subsequent model year engines, in addition to the

requirements of section (d)(4.3.2)(B) above, the denominator(s) for the following monitors shall be incremented if and only if a regeneration event is commanded for a time greater than or equal to 10 seconds:

(i) Diesel NMHC converting catalyst other aftertreatment assistance functions (sections (e)(5.2.3)(A) and (C))

(ii) PM filter incomplete regeneration (section (e)(8.2.3))

(iii) PM filter active/intrusive injection (section (e)(8.2.6))

(I) For vehicles that employ alternate engine start hardware or strategies (e.g., a vehicle with a start-stop system that does not meet the definition of a hybrid vehicle as defined in section (c)) or alternate-fueled engines, the manufacturer may request Executive Officer approval to use alternate criteria to that set forth in section (d)(4.3.2)(B) above for incrementing the denominator. In general, the Executive Officer shall not approve alternate criteria for vehicles that only employ engine shut off at or near idle/vehicle stop conditions. Executive Officer approval of the alternate criteria shall be based on the equivalence of the alternate criteria to determine the amount of vehicle operation relative to the measure of conventional vehicle operation in accordance with the criteria in section (d)(4.3.2)(B) above.

(J) For hybrid vehicles, in lieu of the criteria in section (d)(4.3.2)(B) above, the denominator for each monitor shall be incremented within ten seconds if and only if the following criteria are satisfied on a single driving cycle:

(i) Cumulative propulsion system active time is greater than or equal to 600 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit;

(ii) Cumulative gasoline engine operation at or above 25 miles per hour or diesel engine operation at or above 1150 rpm, either of which occurs for greater than or equal to 300 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit;

(iii) Continuous vehicle operation at idle (i.e., accelerator pedal released by driver and either vehicle speed less than or equal to one mile per hour or engine speed less than or equal to 200 rpm above normal warmed-up idle (as determined in the drive position for vehicles equipped with an automatic transmission)) for greater than or equal to 30 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit; and

(iv) Cumulative fueled engine operation for greater than or equal to 10 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees

Fahrenheit.

As an alternative, for 2010 through 2015 model year hybrid vehicles, the manufacturer may use the criteria specified in section (d)(4.3.2)(I) in lieu of the criteria specified in section (d)(4.3.2)(J) above.

(4.4) Ratio Specifications

(4.4.1) Definition: The ratio is defined as the numerator divided by the denominator.

(4.5) Disablement of Numerators and Denominators

(4.5.1) Within 10 seconds of a malfunction being detected (i.e., a pending, confirmed, or MIL-on fault code being stored) that disables a monitor required to meet the monitoring conditions in section (d)(3.2), the OBD system shall disable further incrementing of the corresponding numerator and denominator for each monitor that is disabled. When the malfunction is no longer detected (e.g., the pending code is erased through self-clearing or through a scan tool command), incrementing of all corresponding numerators and denominators shall resume within 10 seconds.

(4.5.2) Within 10 seconds of the start of a PTO (see section (c)) operation that disables a monitor required to meet the monitoring conditions in section (d)(3.2), the OBD system shall disable further incrementing of the corresponding numerator and denominator for each monitor that is disabled. When the PTO operation ends, incrementing of all corresponding numerators and denominators shall resume within 10 seconds.

(4.5.3) The OBD system shall disable further incrementing of all numerators and denominators within 10 seconds if a malfunction of any component used to determine if the criteria of sections (d)(4.3.2)(B) are satisfied (i.e., vehicle speed/calculated load, ambient temperature, elevation, idle operation, or time of operation) has been detected (i.e., a pending, confirmed, or MIL-on fault code has been stored). Incrementing of all numerators and denominators shall resume within 10 seconds from when the malfunction is no longer present (e.g., pending code erased through self-clearing or by a scan tool command).

(5) Standardized tracking and reporting of monitor performance.

(5.1) For monitors required to track and report in-use monitor performance in section (d)(3.2), the performance data shall be tracked and reported in accordance with the specifications in sections (d)(4), (d)(5), and (h)(5.1). The OBD system shall separately report an in-use monitor performance numerator and denominator for each of the following components:

(5.1.1) For diesel engines, fuel system, NMHC catalyst, NOx catalyst, exhaust gas sensor, EGR/VVT system, PM filter, boost pressure control system, and NOx adsorber. The OBD system shall also report a general

denominator and an ignition cycle counter in the standardized format specified in sections (d)(5.5), (d)(5.6), and (h)(5.1).

(5.1.2) For gasoline engines, catalyst bank 1, catalyst bank 2, primary oxygen sensor bank 1, primary oxygen sensor bank 2, secondary oxygen sensor evaporative leak detection system, EGR/VVT system, and secondary air system. The OBD system shall also report a general denominator and an ignition cycle counter in the standardized format specified in sections (d)(5.5), (d)(5.6), and (h)(5.1).

(5.2) Numerator

(5.2.1) The OBD system shall report a separate numerator for each of the components listed in section (d)(5.1).

(5.2.2) For specific components or systems that have multiple monitors that are required to be reported under section (e) (e.g., exhaust gas sensor bank 1 may have multiple monitors for sensor response or other sensor characteristics), the OBD system shall separately track numerators and denominators for each of the specific monitors and report only the corresponding numerator and denominator for the specific monitor that has the lowest numerical ratio. If two or more specific monitors have identical ratios, the corresponding numerator and denominator for the specific monitor that has the highest denominator shall be reported for the specific component.

(5.2.3) The numerator(s) shall be reported in accordance with the specifications in section (h)(5.1.2)(A).

(5.3) Denominator

(5.3.1) The OBD system shall report a separate denominator for each of the components listed in section (d)(5.1).

(5.3.2) The denominator(s) shall be reported in accordance with the specifications in section (h)(5.1.2)(A).

(5.4) Ratio

(5.4.1) For purposes of determining which corresponding numerator and denominator to report as required in section (d)(5.2.2), the ratio shall be calculated in accordance with the specifications in section (h)(5.1.2)(B).

(5.5) Ignition cycle counter

(5.5.1) Definition:

(A) The ignition cycle counter is defined as a counter that indicates the number of ignition cycles a vehicle has experienced as defined in section (d)(5.5.2)(B).

(B) The ignition cycle counter shall be reported in accordance with the

specifications in section (h)(5.1.2)(A).

(5.5.2) Specifications for incrementing:

(A) The ignition cycle counter, when incremented, shall be incremented by an integer of one. The ignition cycle counter may not be incremented more than once per ignition cycle.

(B) The ignition cycle counter shall be incremented within 10 seconds if and only if the following criteria are met:

(i) Except as required in section (d)(5.5.2)(B)(ii) below, the engine exceeds an engine speed of 50 to 150 rpm below the normal, warmed-up idle speed (as determined in the drive position for vehicles equipped with an automatic transmission) for at least two seconds plus or minus one second.

(ii) For hybrid vehicles, the vehicle meets the propulsion system active definition (see section (c)) for at least two seconds plus or minus one second.

(C) The OBD system shall disable further incrementing of the ignition cycle counter within 10 seconds if a malfunction of any component used to determine if the criteria in section (d)(5.5.2)(B) are satisfied (i.e., engine speed or time of operation) has been detected and the corresponding pending fault code has been stored. The ignition cycle counter may not be disabled from incrementing for any other condition. Incrementing of the ignition cycle counter shall resume within 10 seconds when the malfunction is no longer present (e.g., pending code erased through self-clearing or by a scan tool command).

(5.6) General Denominator

(5.6.1) Definition:

(A) The general denominator is defined as a measure of the number of times a vehicle has been operated as defined in section (d)(5.6.2)(B).

(B) The general denominator shall be reported in accordance with the specifications in section (h)(5.1.2)(A).

(5.6.2) Specifications for incrementing:

(A) The general denominator, when incremented, shall be incremented by an integer of one. The general denominator may not be incremented more than once per driving cycle.

(B) The general denominator shall be incremented within 10 seconds if and only if the criteria identified in section (d)(4.3.2)(B) are satisfied on a single driving cycle.

(C) The OBD system shall disable further incrementing of the general

denominator within 10 seconds if a malfunction of any component used to determine if the criteria in section (d)(4.3.2)(B) are satisfied (i.e., vehicle speed/load, ambient temperature, elevation, idle operation, or time of operation) has been detected and the corresponding pending fault code has been stored. The general denominator may not be disabled from incrementing for any other condition (e.g., the disablement criteria in sections (d)(4.5.1) and (d)(4.5.2) may not disable the general denominator). Incrementing of the general denominator shall resume within 10 seconds when the malfunction is no longer present (e.g., pending code erased through self-clearing or by a scan tool command).

(6) Malfunction Criteria Determination.

(6.1) In determining the malfunction criteria for diesel engine monitors in sections (e) and (g) that are required to indicate a malfunction before emissions exceed an emission threshold based on any applicable standard (e.g., 2.0 times any of the applicable standards), the manufacturer shall:

(6.1.1) Use the emission test cycle and standard (i.e., FTP or SET) determined by the manufacturer, through use of data and/or engineering analysis, to be more stringent (i.e., to result in higher emissions with the same level of monitored component malfunction) as the "applicable standard". The manufacturer shall use data and/or engineering analysis to determine the test cycle and standard that is more stringent.

(6.1.2) Identify in the certification documentation required under section (j), the test cycle and standard determined by the manufacturer to be more stringent for each applicable monitor.

(6.1.3) If the Executive Officer reasonably believes that a manufacturer has incorrectly determined the test cycle and standard that is more stringent, the Executive Officer shall require the manufacturer to provide emission data and/or engineering analysis showing that the other test cycle and standard are less stringent.

(6.2) On engines equipped with emission controls that experience infrequent regeneration events, a manufacturer shall adjust the emission test results that are used to determine the malfunction criterion for monitors that are required to indicate a malfunction before emissions exceed a certain emission threshold (e.g., 2.0 times any of the applicable standards). Except as provided in section (d)(6.2.3), for each monitor, the manufacturer shall adjust the emission result using the procedure described in CFR title 40, part 86.004-28(i) with the component for which the malfunction criteria is being established deteriorated to the malfunction threshold. The adjusted emission value shall be used for purposes of determining whether or not the specified emission threshold is exceeded (e.g., a malfunction must be detected before the adjusted emission value exceeds 2.0 times any applicable standard).

(6.2.1) For purposes of section (d)(6.2), "regeneration" means an event during

which emissions levels change while the emission control performance is being restored by design.

(6.2.2) For purposes of section (d)(6.2), "infrequent" means having an expected frequency of less than once per FTP cycle.

(6.2.3) In lieu of using the procedure described in CFR title 40, part 86.004-28(i), the manufacturer may submit an alternate plan to calculate the adjustment factors for determining the adjusted emission values to the Executive Officer for review and approval. Executive Officer approval of the plan shall be conditioned upon the manufacturer providing data and/or engineering evaluation demonstrating the procedure is consistent with good engineering judgment in determining appropriate modifications to the tailpipe certification adjustment factors.

(6.3) In lieu of meeting the malfunction criteria for gasoline engine monitors in sections (f) and (g), the manufacturer may request Executive Officer approval to utilize OBD systems certified to the requirements of title 13, CCR section 1968.2.1 on medium-duty engines or vehicles. The Executive Officer shall approve the request upon finding that the manufacturer has used good engineering judgment in determining equivalent malfunction detection criteria on the heavy-duty engine.

(7) Implementation Schedule

(7.1) Except as specified in sections (d)(7.4) and (d)(7.5) for small volume manufacturers and alternate-fueled engines, for the 2010 through 2012 model year engines:

(7.1.1) Full OBD. Except as specified in section (d)(7.1.3) below, a manufacturer shall implement an OBD system meeting the requirements of section 1971.1.1 on one engine rating (i.e., the OBD parent rating) within one of the manufacturer's engine families. The OBD parent rating shall be from the manufacturer's heavy-duty engine family with the highest weighted sales number for the 2010 model year and shall be the engine rating with the highest weighted sales number within that engine family.

(7.1.2) Extrapolated OBD. For all other engine ratings within the engine family selected according to section (d)(7.1.1) (i.e., the OBD child ratings), except as specified in section (d)(7.1.3) below), a manufacturer shall implement an OBD system meeting the requirements of section 1971.1.1 with the exception that the OBD system is not required to detect a malfunction prior to exceeding the emission thresholds specified in the malfunction criteria in sections (e) through (g). In lieu of detecting a malfunction prior to exceeding the emission thresholds, a manufacturer shall submit a plan for Executive Officer review and approval detailing the engineering evaluation the manufacturer will use to establish the malfunction criteria for the OBD child ratings. The Executive Officer shall approve the plan upon determining that the manufacturer is using good engineering judgment to

establish the malfunction criteria for robust detection of malfunctions, including consideration of differences of base engine, calibration, emission control components, and emission control strategies.

(7.1.3) For all engine ratings (i.e., OBD parent and OBD child ratings) within the engine family selected according to (d)(7.1.1):

(A) The OBD system is exempt from having to comply with the standardization requirements set forth in the incorporated documents to this regulation (e.g., SAE J1939 defined format) within the following sections:

(i) (d)(1.2) and (h)(2) (standardized connector)

(ii) (d)(2.1.1) and (2.1.5) (dedicated standardized MIL)

(iii) (h)(3) (communication protocol)

(iv) (h)(4) (standardized communication functions with respect to the requirements to make the data available in a standardized format or in accordance with SAE J1979/1939 specifications)

(v) (h)(5.1.1) and (h)(5.2.1) with respect to the requirements to make the data available in a standardized format or in accordance with SAE J1979/1939 specifications.

(B) The OBD system shall meet the requirements of either sections (d)(2.2.1) and (2.3.1) or (d)(2.2.2) and (2.3.2) regardless of the communication protocol (e.g., standardized, proprietary) used by the OBD system.

(7.1.4) Engine Manufacturer Diagnostic (EMD) Systems. For all engine ratings in the manufacturer's engine families not selected according to section (d)(7.1.1), a manufacturer shall:

(A) Implement an EMD system meeting the requirements of title 13, CCR section 1971 in lieu of meeting the requirements of section 1971.1.1; and

(B) Monitor the NOx aftertreatment (i.e., catalyst, adsorber) on engines so-equipped. A malfunction shall be detected if:

(i) The NOx aftertreatment system has no detectable amount of NOx aftertreatment capability (i.e., NOx catalyst conversion or NOx adsorption);

(ii) The NOx aftertreatment substrate is completely destroyed, removed, or missing; or

(iii) The NOx aftertreatment assembly is replaced with a straight pipe.

(7.2) Except as specified in section (d)(7.5) for alternate-fueled engines, for the 2013 through 2015 model year engines:

(7.2.1) A manufacturer shall be required to define one or more OBD groups to cover all engine ratings in all engine families.

(7.2.2) Full OBD. A manufacturer shall implement an OBD system meeting the requirements of section 1971.1.1:

(A) On all engine ratings (i.e., OBD parent and OBD child ratings) within the engine family selected according to section (d)(7.1.1); and

(B) On one engine rating (i.e., OBD parent rating) within each of the manufacturer's OBD groups. The OBD parent rating shall be the engine rating with the highest weighted sales number for the 2013 model year within each OBD group.

(7.2.3) Extrapolated OBD. For all engine ratings not subject to section (d)(7.2.2) (i.e., OBD child ratings), a manufacturer shall implement an OBD system meeting the requirements of section 1971.1.1 with the exception that the OBD system is not required to detect a malfunction prior to exceeding the emission thresholds specified in the malfunction criteria in sections (e) through (g). In lieu of detecting a malfunction prior to exceeding the emission thresholds, a manufacturer shall submit a plan for Executive Officer review and approval detailing the engineering evaluation the manufacturer will use to establish the malfunction criteria for the OBD child ratings. The Executive Officer shall approve the plan upon determining that the manufacturer is using good engineering judgment to establish the malfunction criteria for robust detection of malfunctions, including consideration of differences of base engine, calibration, emission control components, and emission control strategies.

(7.3) Except as specified in section (d)(7.5) for alternate-fueled engines, for the 2016 and subsequent model year engines:

(7.3.1) A manufacturer shall implement an OBD system meeting the requirements of section 1971.1.1 on all engine ratings in all engine families.

(7.4) Small volume manufacturers shall be exempt from the requirements of section 1971.1.1 for 2010 through 2012 model year engines. For purposes of this requirement, a small volume manufacturer is defined as a manufacturer with projected engine sales for California heavy-duty vehicles of less than 1200 engines per year for the 2010 model year.

(7.5) For alternate-fueled engines:

(7.5.1) For 2010 through 2012 model year engines, a manufacturer shall be exempt from the requirements of section 1971.1.1.

(7.5.2) For 2013 through 2017 model year engines, the manufacturer shall:

(A) Implement an EMD system meeting the requirements of title 13, CCR section 1971 in lieu of meeting the requirements of section 1971.1.1; and

(B) Monitor the NOx aftertreatment (i.e., catalyst, adsorber) on engines so-equipped. A malfunction shall be detected if:

(i) The NOx aftertreatment system has no detectable amount of NOx

aftertreatment capability (i.e., NOx catalyst conversion or NOx adsorption);

(ii) The NOx aftertreatment substrate is completely destroyed, removed, or missing; or

(iii) The NOx aftertreatment assembly is replaced with a straight pipe.

(7.5.3) For 2018 and subsequent model year engines, a manufacturer shall implement an OBD system meeting the requirements of section 1971.1.1. The manufacturer shall submit a plan to the Executive Officer for approval of the monitoring requirements in sections (e) through (g) determined by the manufacturer to be applicable to the engine. Executive Officer approval shall be based on the appropriateness of the monitoring plan with respect to the components and systems on the engine (e.g., a spark-ignited dedicated CNG engine with a particulate matter (PM) filter and a selective catalytic reduction (SCR) system would be monitored in accordance with the misfire monitoring requirements in section (f) for spark-ignited engines and with the PM filter and SCR system monitoring requirements in section (e) for diesel engines typically equipped with the same components).

(7.6) For 2013 model year hybrid vehicles: In lieu of meeting all other requirements of section 1971.1.1, a manufacturer may meet the alternative requirements set forth in sections (d)(7.6.1) through (d)(7.6.5) below for 2013 model year hybrid vehicles:

(7.6.1) A California-certified 2013 model year engine shall be used as the base engine in the hybrid vehicle design.

(7.6.2) Any modifications made to the base engine's certified OBD system shall be solely for the purpose of preventing false malfunction determinations that could otherwise occur as a result of the integration of the hybrid system hardware and software, and such modifications shall only be made to the extent necessary to achieve this purpose. All modifications are subject to Executive Officer approval. The Executive Officer shall grant approval upon determining that the modifications are necessary and reasonable for the purposes of preventing false malfunction determinations on in-use hybrid vehicles.

(7.6.3) Notwithstanding section (d)(7.6.2) above, no modifications shall be made that would render the certified base engine noncompliant with the EMD plus NOx aftertreatment monitoring requirements set forth in section (d)(7.1.4).

(7.6.4) For all hybrid components, manufacturers shall be exempt from the monitoring requirements of section (g)(3).

(7.6.5) Manufacturers shall apply for certification to the requirements of this section. The application for certification shall identify and describe the

certified base engine, the hybrid system mated to it, all changes made to the certified engine along with the rationale describing the need for each change, and the vehicle applications into which the hybrid system will be installed.

(e) *Monitoring Requirements for Diesel/Compression-Ignition Engines.*

(1) Fuel System Monitoring

(1.1) Requirement:

The OBD system shall monitor the fuel delivery system to determine its ability to comply with applicable standards. The individual electronic components (e.g., actuators, valves, sensors, pumps) that are used in the fuel system and not specifically addressed in this section shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(1.2) Malfunction Criteria:

(1.2.1) Fuel system pressure control: The OBD system shall detect a malfunction of the fuel system pressure control system (e.g., fuel, hydraulic fluid) when the fuel system pressure control system is unable to maintain an engine's NMHC, NOx, or CO emissions at or below 2.0 times the applicable standards or the engine's PM emissions at or below the applicable standard plus 0.02 grams per brake horsepower-hour (g/bhp-hr). For engines in which no failure or deterioration of the fuel system pressure control could result in an engine's emissions exceeding these emission levels, the OBD system shall detect a malfunction when the system has reached its control limits such that the commanded fuel system pressure cannot be delivered.

(1.2.2) Injection quantity: The OBD system shall detect a malfunction of the fuel injection system when the system is unable to deliver the commanded quantity of fuel necessary to maintain an engine's NMHC, CO, and NOx emissions at or below 2.0 times the applicable standards or the engine's PM emissions at or below the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the fuel injection quantity could result in an engine's emissions exceeding these emission levels, the OBD system shall detect a malfunction when the system has reached its control limits such that the commanded fuel quantity cannot be delivered.

(1.2.3) Injection Timing: The OBD system shall detect a malfunction of the fuel injection system when the system is unable to deliver fuel at the proper crank angle/timing (e.g., injection timing too advanced or too retarded) necessary to maintain an engine's NMHC, CO, and NOx emissions at or below 2.0 times the applicable standards or the engine's PM emissions at or below the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the fuel injection timing could result in an engine's emissions exceeding these emission levels, the OBD system shall

detect a malfunction when the system has reached its control limits such that the commanded fuel injection timing cannot be achieved.

(1.2.4) Feedback control: Except as provided for in section (e)(1.2.5), if the engine is equipped with feedback or feed-forward control of the fuel system (e.g., feedback control of pressure or pilot injection quantity), the OBD system shall detect a malfunction:

(A) If the system fails to begin control within a manufacturer specified time interval;

(B) If a failure or deterioration causes open loop or default operation; or

(C) If the control system has used up all of the adjustment allowed by the manufacturer or reached its maximum authority and cannot achieve the target.

(1.2.5) A manufacturer may request Executive Officer approval to temporarily disable monitoring for the malfunction criteria specified in section (e)(1.2.4)(C) during conditions that a manufacturer cannot robustly distinguish between a malfunctioning system and a properly operating system. The Executive Officer shall approve the disablement upon the manufacturer submitting data and/or analysis demonstrating that the control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions with all of the adjustment allowed by the manufacturer used up.

(1.2.6) In lieu of detecting the malfunctions specified in sections (e)(1.2.4)(A) and (B) with a fuel system-specific monitor, the OBD system may monitor the individual parameters or components that are used as inputs for fuel system feedback control provided that the monitors detect all malfunctions that meet the criteria in sections (e)(1.2.4)(A) and (B).

(1.2.7) For purposes of determining the fuel system malfunction criteria in sections (e)(1.2.1) through (1.2.3):

(A) For 2010 through 2012 model year engines, the malfunction criteria shall be established by using a fault that affects either a single injector or all injectors equally.

(B) For 2013 and subsequent model year engines, for section (e)(1.2.1), the malfunction criteria shall be established by using a fault that affects all injectors equally. Additionally, for systems that have single component failures which could affect a single injector (e.g., systems that build injection pressure within the injector that could have a single component pressure fault caused by the injector itself), the malfunction criteria shall also be established by using a fault that affects a single injector.

(C) For 2013 and subsequent model year engines, for sections (e)(1.2.2) through (1.2.3), the malfunction criteria shall be established by both (1) a

fault that affects all the injectors equally and (2) a fault that affects only one injector.

(1.3) Monitoring Conditions:

(1.3.1) Except as provided in sections (e)(1.3.2) and (e)(1.3.4), the OBD system shall monitor continuously for malfunctions identified in sections (e)(1.2.1) and (e)(1.2.4) (i.e., fuel pressure control and feedback operation).

(1.3.2) For fuel systems that achieve injection fuel pressure within the injector or increase pressure within the injector (e.g. in the injector of an amplified common rail system), manufacturers may request Executive Officer approval to define the monitoring conditions for malfunctions identified in sections (e)(1.2.1) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). The Executive Officer shall approve the monitoring conditions upon the manufacturer submitting data and/or analysis identifying all possible failure modes and the effect each has (e.g., failure modes and effects analysis) on fuel pressure across the entire range of engine operating conditions, and upon the Executive Officer determining based on the data and/or analysis that the monitoring conditions allow for robust detection of all causes of fuel pressure malfunctions.

(1.3.3) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(1.2.2) and (e)(1.2.3) (i.e., injection quantity and timing) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For all 2013 and subsequent model year engines, for purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (e)(1.2.2) and (e)(1.2.3) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(1.3.4) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that which is technically necessary.

(1.4) MIL Illumination and Fault Code Storage:

(1.4.1) General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(1.4.2) Additionally, for malfunctions identified in section (e)(1.2.1) (i.e., fuel pressure control) on all 2013 and subsequent model year engines:

(A) A pending fault code shall be stored immediately upon the fuel system exceeding the malfunction criteria established pursuant to section (e)(1.2.1).

(B) Except as provided below, if a pending fault code is stored, the OBD system shall immediately illuminate the MIL and store a confirmed/MIL-on fault code if a malfunction is again detected during either of the following two events: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle; or (b) on the next driving cycle in which similar conditions (see section (c)) to those that occurred when the pending fault code was stored are encountered.

(C) The pending fault code may be erased at the end of the next driving cycle in which similar conditions have been encountered without an exceedance of the specified fuel system malfunction criteria. The pending code may also be erased if similar conditions are not encountered during the 80 driving cycles immediately after the initial detection of a malfunction for which the pending code was set.

(D) Storage of freeze frame conditions.

(i) For 2013 through 2015 model year engines, a manufacturer shall store and erase freeze frame conditions either in conjunction with storing and erasing a pending fault code or in conjunction with storing and erasing a confirmed/MIL-on fault code. For 2016 and subsequent model year engines, a manufacturer shall store freeze frame conditions in conjunction with storing and erasing a pending fault code in accordance with section (d)(2.2.1)(D)(iii) or (d)(2.2.2)(D).

(ii) If freeze frame conditions are stored for a malfunction other than misfire (see section (e)(2)) or fuel system malfunction when a fault code is stored as specified in section (e)(1.4.2) above, the stored freeze frame information shall be replaced with freeze frame information regarding the fuel system malfunction.

(E) Storage of fuel system conditions for determining similar conditions of operation.

(i) Upon detection of a fuel system malfunction under section (e)(1.4.2), the OBD system shall store the engine speed, load, and warm-up status of the first fuel system malfunction that resulted in the storage of the pending fault code.

(ii) The manufacturer may request Executive Officer approval to use an alternate definition of similar conditions in lieu of the definition specified in section (c). The Executive Officer shall approve the alternate definition upon the manufacturer providing data or analysis demonstrating that the alternate definition provides for equivalent

robustness in detection of fuel system faults that vary in severity depending on engine speed, load, and/or warm-up status.

(F) Extinguishing the MIL. The MIL may be extinguished after three sequential driving cycles in which similar conditions have been encountered without a malfunction of the fuel system.

(2) Misfire Monitoring

(2.1) Requirement:

(2.1.1) The OBD system shall monitor the engine for misfire. The OBD system shall be capable of detecting misfire occurring in one or more cylinders. To the extent possible without adding hardware for this specific purpose, the OBD system shall also identify the specific misfiring cylinder.

(2.1.2) If more than one cylinder is continuously misfiring, a separate fault code shall be stored indicating that multiple cylinders are misfiring. When identifying multiple cylinder misfire, the OBD system is not required to also identify each of the continuously misfiring cylinders individually through separate fault codes.

(2.2) Malfunction Criteria:

(2.2.1) The OBD system shall detect a misfire malfunction when one or more cylinders are continuously misfiring.

(2.2.2) Additionally, for 2013 through 2015 model year engines equipped with sensors that can detect combustion or combustion quality (e.g., for use in homogeneous charge compression ignition (HCCI) control systems) and for 20 percent of 2016 model year diesel engines, 50 percent of 2017 model year diesel engines, and 100 percent of 2018 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation), the OBD system shall detect a misfire malfunction when the percentage of misfire is equal to or exceeds five percent.

(A) Manufacturers shall evaluate the percentage of misfire in 1000 revolution increments.

(B) Subject to Executive Officer approval, a manufacturer may employ other revolution increments. The Executive Officer shall grant approval upon determining that the manufacturer has demonstrated that the strategy would be equally effective and timely in detecting misfire.

(2.2.3) A malfunction shall be detected if the percentage of misfire specified in section (e)(2.2.2) is exceeded regardless of the pattern of misfire events (e.g., random, equally spaced, continuous).

(2.2.4) For multiple cylinder misfire situations that result in a misfire rate greater than or equal to 50 percent of all engine firings, the OBD system shall only be required to detect a misfire malfunction for situations that are caused by a single component failure.

(2.2.5) Upon request by the manufacturer and upon determining that the manufacturer has submitted data and/or engineering evaluation that support the request, the Executive Officer shall revise the percentage of misfire malfunction criteria in section (e)(2.2.2) upward to exclude detection of misfire that cannot cause the engine's NMHC, CO, and NOx emissions to exceed 2.0 times the applicable standards and the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr.

(2.3) Monitoring Conditions:

(2.3.1) Except as provided in section (e)(2.3.2), the OBD system shall monitor for misfires identified in section (e)(2.2.1) during engine idle conditions at least once per driving cycle in which the monitoring conditions for misfire are met. A manufacturer shall submit monitoring conditions to the Executive Officer for approval. The Executive Officer shall approve manufacturer-defined monitoring conditions that are determined (based on manufacturer-submitted data and/or other engineering documentation) to: (i) be technically necessary to ensure robust detection of malfunctions (e.g., avoid false passes and false detection of malfunctions), (ii) require no more than 1000 cumulative engine revolutions, and (iii) do not require any single continuous idle operation of more than 15 seconds to make a determination that a malfunction is present (e.g., a decision can be made with data gathered during several idle operations of 15 seconds or less); or satisfy the requirements of (d)(3.1) with alternative engine operating conditions.

(2.3.2) Manufacturers may request Executive Officer approval to use alternate monitoring conditions (e.g., off-idle) in lieu of the monitoring conditions specified in section (e)(2.3.1). The Executive Officer shall approve alternate monitoring conditions that are determined (based on manufacturer-submitted data and/or other engineering documentation) to ensure equivalent robust detection of malfunctions and equivalent timeliness in detection of malfunctions.

(2.3.3) For misfires identified in section (e)(2.2.2):

(A) The OBD system shall continuously monitor for misfire under the following conditions:

(i) For 2013 through 2018 model year engines and 2019 and subsequent model year engines that are not included in the phase-in specified in section (e)(2.3.3)(A)(ii), under positive torque conditions between 20 percent and 75 percent of peak torque with engine speed up to 75 percent of the maximum engine speed.

(ii) For 20 percent of 2019 model year diesel engines, 50 percent of 2020 model year diesel engines, and 100 percent of 2021 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation), under all positive torque engine speed conditions except within the following range: the engine operating region bound by the positive torque line (i.e., engine torque with transmission in neutral) and the two following points: engine speed of 50 percent of maximum engine speed with the engine torque at the positive torque line, and 100 percent of the maximum engine speed with the engine torque at 10 percent of peak torque above the positive torque line.

(B) If a monitoring system cannot detect all misfire patterns under all required engine speed and load conditions as required in section (e)(2.3.3)(A), the manufacturer may request Executive Officer approval to accept the monitoring system. In evaluating the manufacturer's request, the Executive Officer shall consider the following factors: the magnitude of the region(s) in which misfire detection is limited, the degree to which misfire detection is limited in the region(s) (i.e., the probability of detection of misfire events), the frequency with which said region(s) are expected to be encountered in-use, the type of misfire patterns for which misfire detection is troublesome, demonstration that the monitoring technology employed is not inherently incapable of detecting misfire under required conditions (i.e., compliance can be achieved on other engines), and the extent to which the most reliable monitoring method developed is unable to ensure robust detection of misfire in the region(s). The evaluation shall be based on the following misfire patterns: equally spaced misfire occurring on randomly selected cylinders, single cylinder continuous misfire, and paired cylinder (cylinders firing at the same crank angle) continuous misfire.

(C) A manufacturer may request Executive Officer approval to disable misfire monitoring or employ an alternate malfunction criterion when misfire cannot be distinguished from other effects. Upon determining that the manufacturer has presented documentation that demonstrates the disablement interval or period of use of an alternate malfunction criterion is limited only to that necessary for avoiding false detection, the Executive Officer shall approve the disablement or use of the alternate malfunction criterion. Such disablements may include but are not limited to events involving:

(i) rough road,

(ii) fuel cut,

(iii) gear changes for manual transmission vehicles,

(iv) traction control or other vehicle stability control activation such as anti-lock braking or other engine torque modifications to enhance vehicle stability,

(v) off-board control or intrusive activation of vehicle components or diagnostics during service or assembly plant testing,

(vi) intrusive diagnostics during portions that can significantly affect engine stability, or

(vii) infrequent regeneration events during portions that can significantly affect engine stability.

(2.4) MIL Illumination and Fault Code Storage:

(2.4.1) General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(2.4.2) Additionally, for misfires identified in section (e)(2.2.2):

(A) Upon detection of the percentage of misfire specified in section (e)(2.2.2), the following criteria shall apply for MIL illumination and fault code storage:

(i) A pending fault code shall be stored no later than after the fourth exceedance of the percentage of misfire specified in section (e)(2.2.2) during a single driving cycle.

(ii) If a pending fault code is stored, the OBD system shall illuminate the MIL and store a confirmed/MIL-on fault code within 10 seconds if the percentage of misfire specified in section (e)(2.2.2) is again exceeded four times during: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle; or (b) on the next driving cycle in which similar conditions (see section (c)) to the engine conditions that occurred when the pending fault code was stored are encountered.

(iii) The pending fault code may be erased at the end of the next driving cycle in which similar conditions to the engine conditions that occurred when the pending fault code was stored have been encountered without an exceedance of the specified percentage of misfire. The pending code may also be erased if similar conditions are not encountered during the next 80 driving cycles immediately following initial detection of the malfunction.

(B) Storage of freeze frame conditions.

(i) For 2013 through 2015 model year engines, the OBD system shall store and erase freeze frame conditions either in conjunction with storing and erasing a pending fault code or in conjunction with storing a confirmed/MIL-on fault code and erasing a confirmed/previously MIL-on fault code. For 2016 and subsequent model year engines, a manufacturer shall store freeze frame conditions in conjunction with storing and erasing a pending fault code in accordance with section (d)(2.2.1)(D)(iii) or (d)(2.2.2)(D).

(ii) If freeze frame conditions are stored for a malfunction other than a misfire malfunction when a fault code is stored as specified in section (e)(2.4.2), the stored freeze frame information shall be replaced with freeze frame information regarding the misfire malfunction.

(C) Storage of misfire conditions for similar conditions determination. Upon detection of misfire under section (e)(2.4.2), the OBD system shall store the following engine conditions: engine speed, load, and warm-up status of the first misfire event that resulted in the storage of the pending fault code.

(D) Extinguishing the MIL. The MIL may be extinguished after three sequential driving cycles in which similar conditions have been encountered without an exceedance of the specified percentage of misfire.

(3) Exhaust Gas Recirculation (EGR) System Monitoring

(3.1) Requirement:

(3.1.1) The OBD system shall monitor the EGR system on engines so-equipped for low flow rate, high flow rate, and slow response malfunctions. For engines equipped with EGR coolers (e.g., heat exchangers), the OBD system shall monitor the cooler system for insufficient cooling malfunctions. The individual electronic components (e.g., actuators, valves, sensors) that are used in the EGR system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(3.1.2) For engines with other charge control strategies that affect EGR flow (e.g., systems that modify EGR flow to achieve a desired fresh air flow rate instead of a desired EGR flow rate), the manufacturer shall submit a monitoring plan to the Executive Officer for approval. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and an engineering evaluation that demonstrate that the monitoring plan is as reliable and effective as the monitoring plan required for EGR systems under section (e)(3).

(3.2) Malfunction Criteria:

(3.2.1) Low Flow: The OBD system shall detect a malfunction of the EGR system prior to a decrease from the manufacturer's specified EGR flow rate that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the EGR system that causes a decrease in flow could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction when either the EGR system has reached its control limits such that it cannot increase EGR flow to achieve the commanded flow rate or, for non-feedback controlled EGR systems,

the EGR system has no detectable amount of EGR flow when EGR flow is expected.

(3.2.2) High Flow: The OBD system shall detect a malfunction of the EGR system, including a leaking EGR valve (i.e., exhaust gas flowing through the valve when the valve is commanded closed), prior to an increase from the manufacturer's specified EGR flow rate that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the EGR system that causes an increase in flow could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction when either the EGR system has reached its control limits such that it cannot reduce EGR flow to achieve the commanded flow rate or, for non-feedback controlled EGR systems, the EGR system has maximum detectable EGR flow when little or no EGR flow is expected.

(3.2.3) Slow Response: The OBD system shall detect a malfunction of the EGR system prior to any failure or deterioration in the EGR system response (e.g., capability to achieve the specified flow rate within a manufacturer-specified time) that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. The OBD system shall monitor the EGR system response under both increasing and decreasing EGR flow rates. For engines in which no failure or deterioration of the EGR system response could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction of the EGR system when no detectable response to a change in commanded or expected flow rate occurs.

(3.2.4) Feedback control: Except as provided for in section (e)(3.2.7), if the engine is equipped with feedback or feed-forward control of the EGR system (e.g., feedback control of flow, valve position, pressure differential across the valve via intake throttle or exhaust backpressure), the OBD system shall detect a malfunction:

(A) If the system fails to begin control within a manufacturer specified time interval;

(B) If a failure or deterioration causes open loop or default operation; or

(C) If the control system has used up all of the adjustment allowed by the manufacturer or reached its maximum authority and cannot achieve the target.

(3.2.5) EGR Cooler Performance: The OBD system shall detect a malfunction of the EGR cooler system prior to a reduction from the manufacturer's specified cooling performance that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the

engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the EGR cooler system could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction when the system has no detectable amount of EGR cooling.

(3.2.6) EGR Catalyst Performance: For catalysts located in the EGR system on 2013 and subsequent model year engines and used to convert constituents to reduce emissions or protect or extend the durability of other emission-related components (e.g., to reduce fouling of an EGR cooler or valve):

(A) Except as provided for in section (e)(3.2.6)(B) below, the OBD system shall detect a malfunction when the catalyst has no detectable amount of constituent (e.g., hydrocarbons, soluble organic fractions) oxidation.

(B) Monitoring of the catalyst is not required if there is no measurable emission impact on the criteria pollutants (i.e., NMHC, CO, NOx, and PM) during any reasonable driving condition in which the catalyst is most likely to affect criteria pollutants.

(3.2.7) A manufacturer may request Executive Officer approval to temporarily disable monitoring for the malfunction criteria specified in section (e)(3.2.4)(C) during conditions that a manufacturer cannot robustly distinguish between a malfunctioning system and a properly operating system. The Executive Officer shall approve the disablement upon the manufacturer submitting data and/or analysis demonstrating that the control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions with all of the adjustment allowed by the manufacturer used up.

(3.2.8) In lieu of detecting the malfunctions specified in sections (e)(3.2.4)(A) and (B) with an EGR system-specific monitor, the OBD system may monitor the individual parameters or components that are used as inputs for EGR system feedback control provided that the monitors detect all malfunctions that meet the criteria in sections (e)(3.2.4)(A) and (B).

(3.2.9) For purposes of determining the EGR cooler performance malfunction criteria in section (e)(3.2.5) for EGR cooler systems that consist of more than one cooler (e.g., a pre-cooler and a main cooler, two or more coolers in series), the manufacturer shall submit an EGR cooler system aging and monitoring plan to the Executive Officer for review and approval. The plan shall include the description and location of each component, the monitoring strategy for each component and combination of components, and the method for determining the malfunction criteria of section (e)(3.2.5) including the deterioration/aging process. Executive Officer approval of the plan shall be based on the representativeness of the aging to real world EGR cooler system component deterioration under normal and malfunctioning engine operating conditions and the effectiveness of the method used to determine the malfunction criteria of section (e)(3.2.5).

(3.3) Monitoring Conditions:

(3.3.1) Except as provided in section (e)(3.3.4), the OBD system shall monitor continuously for malfunctions identified in sections (e)(3.2.1), (3.2.2), and (e)(3.2.4) (i.e., EGR low and high flow, feedback control).

(3.3.2) Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(3.2.3) (i.e., slow response) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (e)(3.2.3) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(3.3.3) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(3.2.5) and (e)(3.2.6) (i.e., cooler performance and EGR catalyst performance) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (e)(3.2.5) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(3.3.4) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under specific conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions (e.g., disable EGR low flow monitoring when no or very little flow is commanded, disable EGR high and low flow monitoring when freezing may affect performance of the system). The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating EGR system cannot be distinguished from a malfunctioning EGR system and that the disablement interval is limited only to that which is technically necessary.

(3.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(4) Boost Pressure Control System Monitoring

(4.1) Requirement:

(4.1.1) The OBD system shall monitor the boost pressure control system (e.g., turbocharger) on engines so-equipped for under and over boost malfunctions and slow response malfunctions. For engines equipped with charge air cooler systems, the OBD system shall monitor the charge air cooler system for cooling system performance malfunctions. The individual

electronic components (e.g., actuators, valves, sensors) that are used in the boost pressure control system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(4.1.2) For engines with other charge control strategies that affect boost pressure (e.g., systems that modify boost pressure to achieve a desired air-fuel ratio instead of a desired boost pressure), the manufacturer shall submit a monitoring plan to the Executive Officer for approval. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and an engineering evaluation that demonstrate that the monitoring plan is as reliable and effective as the monitoring plan required for boost pressure control systems under section (e)(4).

(4.2) Malfunction Criteria:

(4.2.1) Underboost: The OBD system shall detect a malfunction of the boost pressure control system prior to a decrease from the manufacturer's commanded or expected boost pressure that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the boost pressure control system that causes a decrease in boost could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction when either the boost system has reached its control limits such that it cannot increase boost to achieve the commanded boost pressure or, for non-feedback controlled boost systems, the boost system has no detectable amount of boost when boost is expected.

(4.2.2) Overboost: The OBD system shall detect a malfunction of the boost pressure control system prior to an increase from the manufacturer's commanded or expected boost pressure that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the boost pressure control system that causes an increase in boost could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction when either the boost system has reached its control limits such that it cannot decrease boost to achieve the commanded boost pressure or, for non-feedback controlled boost systems, the boost system has no detectable amount of boost boost is expected.

(4.2.3) Slow response: when

(A) For 2010 through 2012 model year engines equipped with variable geometry turbochargers (VGT), the OBD system shall detect a malfunction prior to any failure or deterioration in the capability of the VGT system to achieve the commanded turbocharger geometry within a manufacturer-specified time that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM

10/4/12 PER AGENCY REQUEST LSM

emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the VGT system response could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction of the VGT system when no detectable response to a change in commanded turbocharger geometry occurs.

(B) For 2013 and subsequent model year engines, the OBD system shall detect a malfunction prior to any failure or deterioration in the boost pressure control system response (e.g., capability to achieve the commanded or expected boost pressure within a manufacturer-specified time) that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the boost system response could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction of the boost system when no detectable response to a commanded or expected change in boost pressure occurs.

(4.2.4) Charge Air Undercooling: The OBD system shall detect a malfunction of the charge air cooling system prior to a decrease from the manufacturer's specified cooling rate that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the charge air cooling system that causes a decrease in cooling performance could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction when the system has no detectable amount of charge air cooling.

(4.2.5) Feedback control: Except as provided for in section (e)(4.2.6), if the engine is equipped with feedback or feed-forward control of the boost pressure system (e.g., control of variable geometry turbocharger position, turbine speed, manifold pressure) the OBD system shall detect a malfunction:

(A) If the system fails to begin control within a manufacturer specified time interval;

(B) If a failure or deterioration causes open loop or default operation; or

(C) If the control system has used up all of the adjustment allowed by the manufacturer or reached its maximum authority and cannot achieve the target.

(4.2.6) A manufacturer may request Executive Officer approval to temporarily disable monitoring for the malfunction criteria specified in section (e)(4.2.5)(C) during conditions that a manufacturer cannot robustly distinguish between a malfunctioning system and a properly operating system. The Executive Officer shall approve the disablement upon the manufacturer submitting data and/or analysis demonstrating that the

control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions with all of the adjustment allowed by the manufacturer used up.

(4.2.7) In lieu of detecting the malfunctions specified in sections (e)(4.2.5)(A) and (B) with a boost pressure system-specific monitor, the OBD system may monitor the individual parameters or components that are used as inputs for boost pressure system feedback control provided that the monitors detect all malfunctions that meet the criteria in sections (e)(4.2.5)(A) and (B).

(4.2.8) For purposes of determining the charge air cooling performance malfunction criteria in section (e)(4.2.4) for charge air cooling systems that consist of more than one cooler (e.g., a pre-cooler and a main cooler, two or more coolers in series), the manufacturer shall submit a charge air cooling system aging and monitoring plan to the Executive Officer for review and approval. The plan shall include the description and location of each component, the monitoring strategy for each component and combination of components, and the method for determining the malfunction criteria of section (e)(4.2.4) including the deterioration/aging process. Executive Officer approval of the plan shall be based on the representativeness of the aging to real world charge air cooling system component deterioration under normal and malfunctioning engine operating conditions and the effectiveness of the method used to determine the malfunction criteria of section (e)(4.2.4).

(4.3) Monitoring Conditions:

(4.3.1) Except as provided in section (e)(4.3.4), the OBD system shall monitor continuously for malfunctions identified in sections (e)(4.2.1), (4.2.2), and (4.2.5) (i.e., over and under boost, feedback control).

(4.3.2) Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(4.2.3) (i.e., slow response) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (e)(4.2.3) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(4.3.3) Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(4.2.4) (i.e., charge air cooler performance) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (e)(4.2.4) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(4.3.4) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions (e.g., disable monitoring of underboost when commanded or expected boost pressure is very low). The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that which is technically necessary.

(4.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(5) Non-Methane Hydrocarbon (NMHC) Converting Catalyst Monitoring

(5.1) Requirement: The OBD system shall monitor the NMHC converting catalyst(s) for proper NMHC conversion capability. For engines equipped with catalyzed PM filters that convert NMHC emissions, the catalyst function of the PM filter shall be monitored in accordance with the PM filter requirements in section (e)(8).

(5.2) Malfunction Criteria:

(5.2.1) For purposes of section (e)(5), each catalyst in a series configuration that converts NMHC shall be monitored either individually or in combination with others.

(5.2.2) Conversion Efficiency:

(A) For 2010 through 2012 model year engines, the OBD system shall detect an NMHC catalyst malfunction when the catalyst conversion capability decreases to the point that NMHC emissions exceed 2.0 times any of the applicable standards.

(B) For 2013 and subsequent model year engines, the OBD system shall detect an NMHC catalyst malfunction when the catalyst conversion capability decreases to the point that NMHC emissions exceed 2.0 times any of the applicable standards or NOx emissions exceed any of the applicable standards by more than 0.2 g/bhp-hr (e.g., cause emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr).

(C) If no failure or deterioration of the catalyst conversion capability could result in an engine's NMHC or NOx emissions exceeding the applicable malfunction criteria of section (e)(5.2.2), the OBD system shall detect a malfunction when the catalyst has no detectable amount of NMHC or NOx conversion capability.

(5.2.3) Other Aftertreatment Assistance Functions:

(A) For catalysts used to generate an exotherm to assist PM filter regeneration, the OBD system shall detect a malfunction when the catalyst is unable to generate a sufficient exotherm to achieve regeneration of the PM filter.

(B) For 2015 and subsequent model year engines, for catalysts used to generate a feedgas constituency to assist SCR systems (e.g., to increase NO_2 concentration upstream of an SCR system), the OBD system shall detect a malfunction when the catalyst is unable to generate the necessary feedgas constituents for proper SCR system operation. Catalysts are exempt from this monitoring if both of the following criteria are satisfied: (1) no malfunction of the catalyst's feedgas generation ability can cause emissions to increase by 15 percent or more of the applicable standard as measured from an applicable emission test cycle; and (2) no malfunction of the catalyst's feedgas generation ability can cause emissions to exceed the applicable standard as measured from an applicable emission test cycle.

(C) For catalysts located downstream of a PM filter and used to convert NMHC emissions during PM filter regeneration, the OBD system shall detect a malfunction when the catalyst has no detectable amount of NMHC conversion capability.

(D) For catalysts located downstream of an SCR system (e.g., to prevent ammonia slip), the OBD system shall detect a malfunction when the catalyst has no detectable amount of NMHC, CO, NOx, or PM conversion capability. Monitoring of the catalyst is not required if there is no measurable emission impact on the criteria pollutants (i.e., NMHC, CO, NOx, and PM) during any reasonable driving condition in which the catalyst is most likely to affect criteria pollutants (e.g., during conditions most likely to result in ammonia generation or excessive reductant delivery).

(5.2.4) Catalyst System Aging and Monitoring

(A) For purposes of determining the catalyst malfunction criteria in sections (e)(5.2.2) and (5.2.3) for individually monitored catalysts, the manufacturer shall use a catalyst deteriorated to the malfunction criteria using methods established by the manufacturer to represent real world catalyst deterioration under normal and malfunctioning engine operating conditions. If the catalyst system contains catalysts in parallel (e.g., a two bank exhaust system where each bank has its own catalyst), the malfunction criteria shall be determined with the "parallel" catalysts equally deteriorated.

(B) For purposes of determining the catalyst malfunction criteria in sections (e)(5.2.2) and (5.2.3) for catalysts monitored in combination with others, the manufacturer shall submit a catalyst system aging and monitoring plan to the Executive Officer for review and approval. The plan shall include the

description, emission control purpose, and location of each component, the monitoring strategy for each component and/or combination of components, and the method for determining the malfunction criteria of sections (e)(5.2.2) and (5.2.3) including the deterioration/aging process. If the catalyst system contains catalysts in parallel (e.g., a two bank exhaust system where each bank has its own catalyst), the malfunction criteria shall be determined with the "parallel" catalysts equally deteriorated. Executive Officer approval of the plan shall be based on the representativeness of the aging to real world catalyst system component deterioration under normal and malfunctioning engine operating conditions, the effectiveness of the method used to determine the malfunction criteria of section (e)(5.2), the ability of the component monitor(s) to pinpoint the likely area of malfunction and ensure the correct components are repaired/replaced in-use, and the ability of the component monitor(s) to accurately verify that each catalyst component is functioning as designed and as required in sections (e)(5.2.2) and (5.2.3).

(5.3) Monitoring Conditions:

(5.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(5.2.2) and (5.2.3) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (e)(5.2.2) and (5.2.3) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(5.4) MIL Illumination and Fault Code Storage:

(5.4.1) General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(5.4.2) The monitoring method for the catalyst(s) shall be capable of detecting all instances, except diagnostic self-clearing, when a catalyst fault code has been cleared but the catalyst has not been replaced (e.g., catalyst overtemperature histogram approaches are not acceptable).

(6) Oxides of Nitrogen (NOx) Converting Catalyst Monitoring

(6.1) Requirement: The OBD system shall monitor the NOx converting catalyst(s) for proper conversion capability. For engines equipped with selective catalytic reduction (SCR) systems or other catalyst systems that utilize an active/intrusive reductant injection (e.g., active lean NOx catalysts utilizing diesel fuel injection), the OBD system shall monitor the SCR or active/intrusive reductant injection system for proper performance. The individual electronic components (e.g., actuators, valves, sensors, heaters, pumps) in the SCR or active/intrusive reductant injection system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(6.2) Malfunction Criteria: For purposes of section (e)(6), each catalyst in a series configuration that converts NOx shall be monitored either individually or in combination with others.

(6.2.1) Conversion Efficiency:

(A) For 2010 through 2012 model year engines:

(i) The OBD system shall detect a catalyst malfunction when the catalyst conversion capability decreases to the point that would cause an engine's NOx emissions to exceed any of the applicable standards by more than 0.4 g/bhp-hr (e.g., cause emissions to exceed 0.6 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET).

(ii) If no failure or deterioration of the catalyst NOx conversion capability could result in an engine's NOx emissions exceeding any of the applicable standards by more than 0.4 g/bhp-hr, the OBD system shall detect a malfunction when the catalyst has no detectable amount of NOx conversion capability.

(B) For all 2013 model year engines and 2014 and 2015 model year engines that are not included in the phase-in specified in section (e)(6.2.1)(C):

(i) The OBD system shall detect a catalyst malfunction when the catalyst conversion capability decreases to the point that would cause an engine's emissions to exceed the applicable NOx standard by more than 0.4 g/bhp-hr (e.g., cause emissions to exceed 0.6 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard.

(ii) If no failure or deterioration of the catalyst system NOx conversion capability could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria of section (e)(6.2.1)(B)(i), the OBD system shall detect a malfunction when the catalyst has no detectable amount of NOx or NMHC conversion capability.

(C) For at least 20 percent of 2014 model year diesel engines and at least 50 percent of 2015 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation):

(i) The OBD system shall detect a catalyst malfunction when the catalyst conversion capability decreases to the point that would cause an engine's emissions to exceed the applicable NOx standard by more than 0.3 g/bhp-hr (e.g., cause exhaust emissions to exceed 0.5 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard.

(ii) If no failure or deterioration of the catalyst system NOx conversion capability could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria of section (e)(6.2.1)(C)(i), the OBD system shall detect a malfunction when the catalyst has no detectable amount of NOx or NMHC conversion capability.

(D) Except as provided for below in section (e)(6.2.1)(E), for 2016 and subsequent model year engines:

(i) The OBD system shall detect a catalyst malfunction when the catalyst conversion capability decreases to the point that would cause an engine's emissions to exceed the applicable NOx standard by more than 0.2 g/bhp-hr (e.g., cause emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard.

(ii) If no failure or deterioration of the catalyst system NOx conversion capability could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria of section (e)(6.2.1)(D)(i), the OBD system shall detect a malfunction when the catalyst has no detectable amount of NOx or NMHC conversion capability.

(E) In lieu of using the malfunction criteria in section (e)(6.2.1)(D), a manufacturer may continue to use the malfunction criteria in section (e)(6.2.1)(C) for any 2016 model year engine that was previously certified in the 2014 or 2015 model year to the malfunction criteria in section (e)(6.2.1)(C) and carried over to the 2016 model year.

(6.2.2) Selective Catalytic Reduction (SCR) or Other Active/Intrusive Reductant Injection System Performance:

(A) Reductant Delivery Performance:

(i) For 2010 through 2012 model year engines, the OBD system shall detect a malfunction prior to any failure or deterioration of the system to properly regulate reductant delivery (e.g., urea injection, separate injector fuel injection, post injection of fuel, air assisted injection/mixing) that would cause an engine's NOx emissions to exceed any of the applicable standards by more than 0.4 g/bhp-hr (e.g., cause emissions to exceed 0.6 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET). If no failure or deterioration of the SCR system could result in an engine's NOx emissions exceeding any of the applicable standards by more than 0.4 g/bhp-hr, the OBD system shall detect a malfunction when the system has reached its control limits such that it is no longer able to deliver the desired quantity of reductant.

(ii) For all 2013 model year engines and 2014 and 2015 model year engines that are not included in the phase-in specified in section (e)(6.2.2)(A)(iii):

a. The OBD system shall detect a malfunction prior to any failure or deterioration of the system to properly regulate reductant delivery (e.g., urea injection, separate injector fuel injection, post injection of fuel, air assisted injection/mixing) that would cause an engine's emissions to exceed the applicable NOx standard by more than 0.4 g/bhp-hr (e.g., cause emissions to exceed 0.6 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard.

b. If no failure or deterioration of the SCR system could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria of section (e)(6.2.2)(A)(ii)a., the OBD system shall detect a malfunction when the system has reached its control limits such that it is no longer able to deliver the desired quantity of reductant.

(iii) For at least 20 percent of all 2014 model year diesel engines and at least 50 percent of all 2015 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation):

a. The OBD system shall detect a malfunction prior to any failure or deterioration of the system to properly regulate reductant delivery (e.g., urea injection, separate injector fuel injection, post injection of fuel, air assisted injection/mixing) that would cause an engine's emissions to exceed the applicable NOx standard by more than 0.3 g/bhp-hr (e.g., cause emissions to exceed 0.5 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard.

b. If no failure or deterioration of the SCR system could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria of section (e)(6.2.2)(A)(iii)a., the OBD system shall detect a malfunction when the system has reached its control limits such that it is no longer able to deliver the desired quantity of reductant.

(iv) Except as provided for below in section (e)(6.2.2)(A)(v), for 2016 and subsequent model year engines, the OBD system shall detect a system malfunction prior to any failure or deterioration of the system to properly regulate reductant delivery (e.g., urea injection, separate injector fuel injection, post injection of fuel, air assisted injection/mixing) that would cause an engine's emissions to exceed the applicable NOx standard by

more than 0.2 g/bhp-hr (e.g., cause emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard. If no failure or deterioration of the SCR system could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria above, the OBD system shall detect a malfunction when the system has reached its control limits such that it is no longer able to deliver the desired quantity of reductant.

(v) In lieu of using the malfunction criteria in section (e)(6.2.2)(A)(iv), a manufacturer may continue to use the malfunction criteria in section (e)(6.2.2)(A)(iii) for any 2016 model year engine that was previously certified in the 2014 or 2015 model year to the malfunction criteria in section (e)(6.2.2)(A)(iii) and carried over to the 2016 model year.

(B) If the catalyst system uses a reductant other than the fuel used for the engine or uses a reservoir/tank for the reductant that is separate from the fuel tank used for the engine, the OBD system shall detect a malfunction when there is no longer sufficient reductant available to properly operate the reductant system (e.g., the reductant tank is empty).

(C) If the catalyst system uses a reservoir/tank for the reductant that is separate from the fuel tank used for the engine, the OBD system shall detect a malfunction when an improper reductant is used in the reductant reservoir/tank (e.g., the reductant tank is filled with something other than the reductant).

(D) Feedback control: Except as provided for in section (e)(6.2.2)(E), if the engine is equipped with feedback or feed-forward control of the reductant injection (e.g., pressure control), the OBD system shall detect a malfunction:

(i) If the system fails to begin control within a manufacturer specified time interval;

(ii) If a failure or deterioration causes open loop or default operation; or

(iii) If the control system has used up all of the adjustment allowed by the manufacturer or reached its maximum authority and cannot achieve the target.

(E) A manufacturer may request Executive Officer approval to temporarily disable monitoring for the malfunction criteria specified in section (e)(6.2.2)(D)(iii) during conditions that a manufacturer cannot robustly distinguish between a malfunctioning system and a properly operating system. The Executive Officer shall approve the disablement upon the manufacturer submitting data and/or analysis demonstrating that the control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions with all of the adjustment allowed by the manufacturer used up.

(F) In lieu of detecting the malfunctions specified in sections (e)(6.2.2)(D)(i) and (ii) with a reductant injection system-specific monitor, the OBD system may monitor the individual parameters or components that are used as inputs for reductant injection feedback control provided that the monitors detect all malfunctions that meet the criteria in sections (e)(6.2.2)(D)(i) and (ii).

(6.2.3) Catalyst System Aging and Monitoring

(A) For purposes of determining the catalyst malfunction criteria in section (e)(6.2.1) for individually monitored catalysts, the manufacturer shall use a catalyst deteriorated to the malfunction criteria using methods established by the manufacturer to represent real world catalyst deterioration under normal and malfunctioning engine operating conditions. If the catalyst system contains catalysts in parallel (e.g., a two bank exhaust system where each bank has its own catalyst), the malfunction criteria shall be determined with the "parallel" catalysts equally deteriorated.

(B) For purposes of determining the catalyst malfunction criteria in section (e)(6.2.1) for catalysts monitored in combination with others, the manufacturer shall submit a catalyst system aging and monitoring plan to the Executive Officer for review and approval. The plan shall include the description, emission control purpose, and location of each component, the monitoring strategy for each component and/or combination of components, and the method for determining the malfunction criteria of section (e)(6.2.1) including the deterioration/aging process. If the catalyst system contains catalysts in parallel (e.g., a two bank exhaust system where each bank has its own catalyst), the malfunction criteria shall be determined with the "parallel" catalysts equally deteriorated. Executive Officer approval of the plan shall be based on the representativeness of the aging to real world catalyst system component deterioration under normal and malfunctioning engine operating conditions, the effectiveness of the method used to determine the malfunction criteria of section (e)(6.2.1), the ability of the component monitor(s) to pinpoint the likely area of malfunction and ensure the correct components are repaired/replaced in-use, and the ability of the component monitor(s) to accurately verify that each catalyst component is functioning as designed and as required in section (e)(6.2.1).

(6.3) Monitoring Conditions:

(6.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(6.2.1), (e)(6.2.2)(A), and (e)(6.2.2)(C) (i.e., catalyst efficiency, reductant delivery performance, and improper reductant) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (e)(6.2.1) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(6.3.2) Except as provided in section (e)(6.3.3), the OBD system shall monitor continuously for malfunctions identified in sections (e)(6.2.2)(B) and (D) (i.e., insufficient reductant, feedback control).

(6.3.3) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that which is technically necessary.

(6.4) MIL Illumination and Fault Code Storage:

(6.4.1) Except as provided below for reductant faults, general requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(6.4.2) If the OBD system is capable of discerning that a system fault is being caused by a empty reductant tank:

(A) The manufacturer may request Executive Officer approval to delay illumination of the MIL if the vehicle is equipped with an alternative indicator for notifying the vehicle operator of the malfunction. The Executive Officer shall approve the request upon determining the alternative indicator is of sufficient illumination and location to be readily visible under all lighting conditions and provides equivalent assurance that a vehicle operator will be promptly notified and that corrective action will be undertaken.

(B) If the vehicle is not equipped with an alternative indicator and the MIL illuminates, the MIL may be immediately extinguished and the corresponding fault codes erased once the OBD system has verified that the reductant tank has been properly refilled and the MIL has not been illuminated for any other type of malfunction.

(C) The Executive Officer may approve other strategies that provide equivalent assurance that a vehicle operator will be promptly notified and that corrective action will be undertaken.

(6.4.3) The monitoring method for the catalyst(s) shall be capable of detecting all instances, except diagnostic self-clearing, when a catalyst fault code has been cleared but the catalyst has not been replaced (e.g., catalyst overtemperature histogram approaches are not acceptable).

(7) NOx Adsorber Monitoring

(7.1) Requirement: The OBD system shall monitor the NOx adsorber(s) on engines so-equipped for proper performance. For engines equipped with active/intrusive injection (e.g., in-exhaust fuel and/or air injection) to achieve

desorption of the NOx adsorber(s), the OBD system shall monitor the active/intrusive injection system for proper performance. The individual electronic components (e.g., injectors, valves, sensors) that are used in the active/intrusive injection system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(7.2) Malfunction Criteria:

(7.2.1) NOx adsorber capability:

(A) For 2010 through 2012 model year engines, the OBD system shall detect a NOx adsorber system malfunction when the NOx adsorber system capability decreases to the point that would cause an engine's NOx emissions to exceed any of the applicable standards by more than 0.3 g/bhp-hr (e.g., cause emissions to exceed 0.5 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET). If no failure or deterioration of the NOx adsorber system capability could result in an engine's NOx emissions exceeding any of the applicable standards by more than 0.3 g/bhp-hr, the OBD system shall detect a malfunction when the system has no detectable amount of NOx adsorber capability.

(B) For 2013 and subsequent model year engines, the OBD system shall detect a NOx adsorber system malfunction when the NOx adsorber capability decreases to the point that would cause an engine's emissions to exceed the applicable NOx standards by more than 0.2 g/bhp-hr (e.g., cause emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET) or 2.0 times the applicable NMHC standard. If no failure or deterioration of the NOx adsorber capability could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria above, the OBD system shall detect a malfunction when the system has no detectable amount of NOx adsorber capability.

(7.2.2) For systems that utilize active/intrusive injection (e.g., in-cylinder post fuel injection, in-exhaust air-assisted fuel injection) to achieve desorption of the NOx adsorber, the OBD system shall detect a malfunction if any failure or deterioration of the injection system's ability to properly regulate injection causes the system to be unable to achieve desorption of the NOx adsorber.

(7.2.3) Feedback control: Except as provided for in section (e)(7.2.4), if the engine is equipped with feedback or feed-forward control of the NOx adsorber or active/intrusive injection system (e.g., feedback control of injection quantity, time), the OBD system shall detect a malfunction:

(A) If the system fails to begin control within a manufacturer specified time interval;

(B) If a failure or deterioration causes open loop or default operation; or

(C) If the control system has used up all of the adjustment allowed by the manufacturer or reached its maximum authority and cannot achieve the target.

(7.2.4) A manufacturer may request Executive Officer approval to temporarily disable monitoring for the malfunction criteria specified in section (e)(7.2.3)(C) during conditions that a manufacturer cannot robustly distinguish between a malfunctioning system and a properly operating system. The Executive Officer shall approve the disablement upon the manufacturer submitting data and/or analysis demonstrating that the control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions with all of the adjustment allowed by the manufacturer used up.

(7.2.5) In lieu of detecting the malfunctions specified in sections (e)(7.2.3)(A) and (B) with a NOx adsorber-specific monitor, the OBD system may monitor the individual parameters or components that are used as inputs for NOx adsorber or active/intrusive injection system feedback control provided that the monitors detect all malfunctions that meet the criteria in sections (e)(7.2.3)(A) and (B).

(7.2.6) For purposes of determining the NOx adsorber system malfunction criteria in section (e)(7.2.1) for NOx adsorber systems that consist of more than one NOx adsorber (e.g., two or more adsorbers in series), the manufacturer shall submit a system aging and monitoring plan to the Executive Officer for review and approval. The plan shall include the description and location of each component, the monitoring strategy for each component and/or combination of components, and the method for determining the malfunction criteria of section (e)(7.2.1) including the deterioration/aging process. Executive Officer approval of the plan shall be based on the representativeness of the aging to real world NOx adsorber system component deterioration under normal and malfunctioning engine operating conditions, the effectiveness of the method used to determine the malfunction criteria of section (e)(7.2.1), the ability of the component monitor(s) to pinpoint the likely area of malfunction and ensure the correct components are repaired/replaced in-use, and the ability of the component monitor(s) to accurately verify that each NOx adsorber system component is functioning as designed and as required in section (e)(7.2.1).

(7.3) Monitoring Conditions:

(7.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(7.2.1) (i.e., adsorber capability) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (e)(7.2.1) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(7.3.2) Except as provided in section (e)(7.3.3), the OBD system shall monitor continuously for malfunctions identified in sections (e)(7.2.2) and (7.2.3) (e.g., injection function, feedback control).

(7.3.3) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that which is technically necessary.

(7.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(8) Particulate Matter (PM) Filter Monitoring

(8.1) Requirement: The OBD system shall monitor the PM filter on engines so-equipped for proper performance. For engines equipped with active regeneration systems that utilize an active/intrusive injection (e.g., in-exhaust fuel injection, in-exhaust fuel/air burner), the OBD system shall monitor the active/intrusive injection system for proper performance. The individual electronic components (e.g., injectors, valves, sensors) that are used in the active/intrusive injection system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(8.2) Malfunction Criteria:

(8.2.1) Filtering Performance:

(A) For 2010 through 2012 model year engines, the OBD system shall detect a malfunction prior to a decrease in the filtering capability of the PM filter (e.g., cracking) that would cause an engine's PM emissions to exceed either of the following thresholds, whichever is higher: 0.07 g/bhp-hr as measured from an applicable emission test cycle (i.e., FTP or SET); or the applicable standard plus 0.06 g/bhp-hr (e.g., 0.07 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr). If no failure or deterioration of the PM filtering performance could result in an engine's PM emissions exceeding these levels, the OBD system shall detect a malfunction when no detectable amount of PM filtering occurs.

(B) For all 2013 model year engines and 2014 and 2015 model year engines that are not included in the phase-in specified in section (e)(8.2.1)(C) the OBD system shall detect a malfunction prior to a decrease in the filtering capability of the PM filter that would cause an engine's PM emissions to exceed either of the following thresholds, whichever is higher: 0.05 g/bhp-hr as measured from an applicable emission test cycle (i.e., FTP or SET);

or the applicable standard plus 0.04 g/bhp-hr (e.g., 0.05 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr). If no failure or deterioration of the PM filtering performance could result in an engine's PM emissions exceeding these levels, the OBD system shall detect a malfunction when no detectable amount of PM filtering occurs.

(C) For 2014 through 2015 model year engines, the manufacturer shall meet one of the following two options below:

(i) For at least 20 percent of 2014 model year diesel engines and at least 20 percent of 2015 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation), the OBD system shall use the malfunction criteria of section (e)(8.2.1)(B) without using the provisions of section (g)(5.1) to exclude specific failure modes.

(ii) For at least 50 percent of 2015 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation), the OBD system shall detect a malfunction prior to a decrease in the filtering capability of the PM filter that would cause an engine's PM emissions to exceed either of the following thresholds, whichever is higher, without using the provisions of section (g)(5.1) to exclude specific failure modes: 0.03 g/bhp-hr as measured from an applicable emission test cycle (i.e., FTP or SET); or the applicable standard plus 0.02 g/bhp-hr (e.g., 0.03 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr). If no failure or deterioration of the PM filtering performance could result in an engine's PM emissions exceeding these levels, the OBD system shall detect a malfunction when no detectable amount of PM filtering occurs.

(D) Except as provided in section (e)(8.2.1)(E), for all 2016 and subsequent model year engines, the OBD system shall detect a malfunction prior to a decrease in the filtering capability of the PM filter that would cause an engine's PM emissions to exceed either of the following thresholds, whichever is higher: 0.03 g/bhp-hr as measured from an applicable emission test cycle (i.e., FTP or SET); or the applicable standard plus 0.02 g/bhp-hr (e.g., 0.03 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr). If no failure or deterioration of the PM filtering performance could result in an engine's PM emissions exceeding these levels, the OBD system shall detect a malfunction when no detectable amount of PM filtering occurs.

(E) In lieu of the malfunction criteria in section (e)(8.2.1)(D), a manufacturer may continue to use the malfunction criteria in section (e)(8.2.1)(C)(i) for any 2016 model year engine that was previously certified in the 2014 or 2015 model year to the malfunction criteria in section (e)(8.2.1)(C)(i) and carried over to the 2016 model year.

(F) For the phase-in schedules described in section (e)(8.2.1)(C) above, the manufacturer may not use an alternate phase-in schedule as defined in section (c) in lieu of the required phase-in schedules.

(8.2.2) Frequent Regeneration: The OBD system shall detect a malfunction when the PM filter regeneration occurs more frequently than (i.e., occurs more often than) the manufacturer's specified regeneration frequency to a level such that it would cause an engine's emissions to exceed the following:

(A) For 2010 through 2012 model year engines, 2.0 times the applicable NMHC standards.

(B) For 2013 and subsequent model year engines, 2.0 times the applicable NMHC standards or the applicable NOx standard by more than 0.2 g/bhp-hr (e.g., cause NOx emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr).

(C) If no failure or deterioration causes an increase in the PM filter regeneration frequency that could result in an engine's emissions exceeding the emission levels specified above, the OBD system shall detect a malfunction when the PM filter regeneration frequency exceeds the manufacturer's specified design limits for allowable regeneration frequency.

(8.2.3) Incomplete regeneration: The OBD system shall detect a regeneration malfunction when the PM filter does not properly regenerate under manufacturer-defined conditions where regeneration is designed to occur.

(8.2.4) Catalyzed PM Filter:

(A) NMHC conversion: For 2015 and subsequent model year engines with catalyzed PM filters that convert NMHC emissions:

(i) The OBD system shall monitor the catalyst function of the PM filter and detect a malfunction when the NMHC conversion capability decreases to the point that NMHC emissions exceed 2.0 times the applicable standards.

(ii) If no failure or deterioration of the NMHC conversion capability could result in an engine's NMHC emissions exceeding 2.0 times the applicable standards, the OBD system shall detect a malfunction when the system has no detectable amount of NMHC conversion capability.

(iii) Catalyzed PM filters are exempt from this monitoring if both of the following criteria are satisfied: (1) no malfunction of the catalyzed PM filter's NMHC conversion capability can cause emissions to increase by 15 percent or more of the applicable standard as measured from an applicable emission test cycle; and (2) no malfunction of the catalyzed PM filter's NMHC conversion capability can cause emissions to exceed the applicable standard as measured from an applicable emission test cycle.

(B) Feedgas generation: For 2016 and subsequent model year engines with catalyzed PM filters used to generate a feedgas constituency to assist SCR systems (e.g., to increase NO_2 concentration upstream of an SCR system), the OBD system shall detect a malfunction when the system is unable to generate the necessary feedgas constituents for proper SCR system operation. Catalyzed PM filters are exempt from this monitoring if both of the following criteria are satisfied: (1) no malfunction of the catalyzed PM filter's feedgas generation ability can cause emissions to increase by 15 percent or more of the applicable standard as measured from an applicable emission test cycle; and (2) no malfunction of the catalyzed PM filter's feedgas generation ability can cause emissions to exceed the applicable standard as measured from an applicable emission test cycle.

(8.2.5) Missing substrate: The OBD system shall detect a malfunction if either the PM filter substrate is completely destroyed, removed, or missing, or if the PM filter assembly is replaced with a muffler or straight pipe.

(8.2.6) Active/Intrusive Injection: For systems that utilize active/intrusive injection (e.g., in-cylinder post fuel injection, in-exhaust air-assisted fuel injection) to achieve regeneration of the PM filter, the OBD system shall detect a malfunction if any failure or deterioration of the injection system's ability to properly regulate injection causes the system to be unable to achieve regeneration of the PM filter.

(8.2.7) Feedback Control: Except as provided for in section (e)(8.2.8), if the engine is equipped with feedback or feed-forward control of the PM filter regeneration (e.g., feedback control of oxidation catalyst inlet temperature, PM filter inlet or outlet temperature, in-cylinder or in-exhaust fuel injection), the OBD system shall detect a malfunction:

(A) If the system fails to begin control within a manufacturer specified time interval;

(B) If a failure or deterioration causes open loop or default operation; or

(C) If the control system has used up all of the adjustment allowed by the manufacturer or reached its maximum authority and cannot achieve the target.

(8.2.8) A manufacturer may request Executive Officer approval to temporarily disable monitoring for the malfunction criteria specified in section (e)(8.2.7)(C) during conditions that a manufacturer cannot robustly distinguish between a malfunctioning system and a properly operating system. The Executive Officer shall approve the disablement upon the manufacturer submitting data and/or analysis demonstrating that the control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions with all of the adjustment allowed by the manufacturer used up.

(8.2.9) In lieu of detecting the malfunctions specified in sections (e)(8.2.7)(A) and (B) with a PM filter-specific monitor, the OBD system may monitor the individual parameters or components that are used as inputs for PM filter regeneration feedback control provided that the monitors detect all malfunctions that meet the criteria in sections (e)(8.2.7)(A) and (B).

(8.3) Monitoring Conditions:

(8.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(8.2.1) through (8.2.6) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (e)(8.2.1) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(8.3.2) Except as provided in section (e)(8.3.3), the OBD system shall monitor continuously for malfunctions identified in section (e)(8.2.7) (i.e., PM filter feedback control).

(8.3.3) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that which is technically necessary.

(8.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(9) Exhaust Gas Sensor Monitoring

(9.1) Requirement:

(9.1.1) The OBD system shall monitor all exhaust gas sensors (e.g., oxygen, air-fuel ratio, NOx) used for emission control system feedback (e.g., EGR control/feedback, SCR control/feedback, NOx adsorber control/feedback) or as a monitoring device for proper output signal, activity, response rate, and any other parameter that can affect emissions.

(9.1.2) For engines equipped with heated exhaust gas sensors, the OBD system shall monitor the heater for proper performance.

(9.2) Malfunction Criteria:

(9.2.1) Air-Fuel Ratio Sensors:

(A) For sensors located upstream of the exhaust aftertreatment:

(i) Sensor performance faults: The OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed any of the applicable standards plus 0.02 g/bhp-hr.

(ii) Circuit faults: The OBD system shall detect malfunctions of the sensor caused by either a lack of circuit continuity or out-of-range values.

(iii) Feedback faults: The OBD system shall detect a malfunction of the sensor when a sensor failure or deterioration causes an emission control system (e.g., EGR, SCR, or NOx adsorber) to stop using that sensor as a feedback or feed-forward input (e.g., causes default or open-loop operation).

(iv) Monitoring capability: To the extent feasible, the OBD system shall detect a malfunction of the sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst, EGR, SCR, or NOx adsorber monitoring).

(B) For sensors located downstream of the exhaust aftertreatment:

(i) Sensor performance faults:

a. For 2010 through 2012 model year engines, the OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's NMHC emissions to exceed 2.5 times any of the applicable standards, cause an engine's NOx emissions to exceed any of the applicable standards by more than 0.3 g/bhp-hr (e.g., cause emissions to exceed 0.5 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET), or cause an engine's PM emissions to exceed (whichever is higher): 0.05 g/bhp-hr as measured from an applicable cycle emission test (i.e., FTP or SET); or any of the applicable standards by more than 0.04 g/bhp-hr (e.g., cause emissions to exceed 0.05 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr).

b. For 2013 and subsequent model year engines, the OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's NMHC emissions to exceed 2.0 times any of the applicable standards,

cause an engine's NOx emissions to exceed any of the applicable standards by more than 0.2 g/bhp-hr (e.g., cause emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET), or cause an engine's PM emissions to exceed (whichever is higher): 0.03 g/bhp-hr as measured from an applicable cycle emission test (i.e., FTP or SET); or any of the applicable standards by more than 0.02 g/bhp-hr (e.g., cause emissions to exceed 0.03 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr).

(ii) Circuit faults: The OBD system shall detect malfunctions of the sensor caused by either a lack of circuit continuity or out-of-range values.

(iii) Feedback faults: The OBD system shall detect a malfunction of the sensor when a sensor failure or deterioration causes an emission control system (e.g., EGR, SCR, or NOx adsorber) to stop using that sensor as a feedback or feed-forward input (e.g., causes default or open-loop operation).

(iv) Monitoring capability: To the extent feasible, the OBD system shall detect a malfunction of the sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst, EGR, SCR, or NOx adsorber monitoring).

(9.2.2) NOx and PM sensors:

(A) Sensor performance faults:

(i) For 2010 through 2012 model year engines, the OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's NOx emissions to exceed any of the applicable standards by more than 0.4 g/bhp-hr (e.g., cause emissions to exceed 0.6 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET), or cause an engine's PM emissions to exceed (whichever is higher): 0.05 g/bhp-hr as measured from an applicable cycle emission test (i.e., FTP or SET); or any of the applicable standards by more than 0.04 g/bhp-hr (e.g., cause emissions to exceed 0.05 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr).

(ii) For all 2013 model year engines and 2014 and 2015 model year engines that are not included in the phase-in specified in section (e)(9.2.2)(A)(iii), the OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that

would cause an engine's NOx emissions to exceed the applicable NOx standard by more than 0.4 g/bhp-hr (e.g., cause emissions to exceed 0.6 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or cause an engine's PM emissions to exceed (whichever is higher): 0.03 g/bhp-hr as measured from an applicable cycle emission test (i.e., FTP or SET); or any of the applicable standards by more than 0.02 g/bhp-hr (e.g., cause emissions to exceed 0.03 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr).

(iii) For at least 20 percent of 2014 model year diesel engines and at least 50 percent of 2015 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation), the OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's NOx emissions to exceed the applicable NOx standard by more than 0.3 g/bhp-hr (e.g., cause emissions to exceed 0.5 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or cause an engine's PM emissions to exceed (whichever is higher): 0.03 g/bhp-hr as measured from an applicable cycle emission test (i.e., FTP or SET); or any of the applicable standards by more than 0.02 g/bhp-hr (e.g., cause emissions to exceed 0.03 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr).

(iv) Except as provided for below in section (e)(9.2.2)(A)(v), for 2016 and subsequent model year engines, the OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's NOx emissions to exceed the applicable NOx standards by more than 0.2 g/bhp-hr (e.g., cause emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET), cause an engine's NMHC emissions to exceed 2.0 times the applicable NMHC standard, or cause an engine's PM emissions to exceed (whichever is higher): 0.03 g/bhp-hr as measured from an applicable cycle emission test (i.e., FTP or SET); or any of the applicable standards by more than 0.02 g/bhp-hr (e.g., cause emissions to exceed 0.03 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr).

(v) In lieu of using the malfunction criteria in section (e)(9.2.2)(A)(iv), a manufacturer may continue to use the malfunction criteria in section (e)(9.2.2)(A)(iii) for any 2016 model year engine that was previously certified in the 2014 or 2015 model year to the malfunction criteria in section (e)(9.2.2)(A)(iii) and carried over to the 2016 model year.

(B) Circuit faults: The OBD system shall detect malfunctions of the sensor caused by either a lack of circuit continuity or out-of-range values.

(C) Feedback faults: The OBD system shall detect a malfunction of the sensor when a sensor failure or deterioration causes an emission control system (e.g., EGR, SCR, or NOx adsorber) to stop using that sensor as a feedback or feed-forward input (e.g., causes default or open-loop operation).

(D) Monitoring capability: To the extent feasible, the OBD system shall detect a malfunction of the sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst, EGR, PM filter, SCR, or NOx adsorber monitoring).

(9.2.3) Other exhaust gas sensors:

(A) For other exhaust gas sensors, the manufacturer shall submit a monitoring plan to the Executive Officer for approval. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and an engineering evaluation that demonstrate that the monitoring plan is as reliable and effective as the monitoring plan required for air-fuel ratio sensors, NOx sensors, and PM sensors under sections (e)(9.2.1) and (e)(9.2.2).

(9.2.4) Sensor Heaters:

(A) The OBD system shall detect a malfunction of the heater performance when the current or voltage drop in the heater circuit is no longer within the manufacturer's specified limits for normal operation (i.e., within the criteria required to be met by the component vendor for heater circuit performance at high mileage). Subject to Executive Officer approval, other malfunction criteria for heater performance malfunctions may be used upon the Executive Officer determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate the monitoring reliability and timeliness to be equivalent to the stated criteria in section (e)(9.2.4)(A).

(B) The OBD system shall detect malfunctions of the heater circuit including open or short circuits that conflict with the commanded state of the heater (e.g., shorted to 12 Volts when commanded to 0 Volts (ground)).

(9.3) Monitoring Conditions:

(9.3.1) Exhaust Gas Sensors

(A) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(9.2.1)(A)(i), (9.2.1)(B)(i), (9.2.2)(A), and (9.2.2)(D) (e.g., sensor performance faults) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (e)(9.2.1)(A)(i), (9.2.1)(B)(i), (9.2.2)(A), and for 2016 and subsequent model year engines, section (e)(9.2.2)(D),

shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(B) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(9.2.1)(A)(iv) and (9.2.1)(B)(iv), (e.g., monitoring capability) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(C) Except as provided in section (e)(9.3.1)(D), monitoring for malfunctions identified in sections (e)(9.2.1)(A)(ii), (9.2.1)(A)(iii), (9.2.1)(B)(ii), (9.2.1)(B)(iii), (9.2.2)(B), and (9.2.2)(C) (i.e., circuit continuity and open-loop malfunctions) shall be conducted continuously.

(D) A manufacturer may request Executive Officer approval to disable continuous exhaust gas sensor monitoring when an exhaust gas sensor malfunction cannot be distinguished from other effects (e.g., disable out-of-range low monitoring during fuel cut conditions). The Executive Officer shall approve the disablement upon determining that the manufacturer has submitted test data and/or documentation that demonstrate a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false detection.

(9.3.2) Sensor Heaters

(A) Manufacturers shall define monitoring conditions for malfunctions identified in section (e)(9.2.4)(A) (i.e., sensor heater performance) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(B) Monitoring for malfunctions identified in section (e)(9.2.4)(B) (i.e., circuit malfunctions) shall be conducted continuously.

(9.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2). To the extent feasible, the OBD system shall separately detect lack of circuit continuity and out-of-range faults as required under sections (e)(9.2.1)(A)(ii), (e)(9.2.1)(B)(ii), and (e)(9.2.2)(B) and store different fault codes for each distinct malfunction (e.g., out-of-range low, out-of-range high, open circuit). Manufacturers are not required to store separate fault codes for lack of circuit continuity faults that cannot be distinguished from other out-of-range circuit faults.

(10) Variable Valve Timing and/or Control (VVT) System Monitoring

(10.1) Requirement: The OBD system shall monitor the VVT system on engines so-equipped for target error and slow response malfunctions. The individual electronic components (e.g., actuators, valves, sensors) that are used in the VVT system shall be monitored in accordance with the comprehensive components requirements in section (g)(3).

(10.2) Malfunction Criteria:

(10.2.1) Target Error: The OBD system shall detect a malfunction prior to any failure or deterioration in the capability of the VVT system to achieve the commanded valve timing and/or control within a crank angle and/or lift tolerance that would cause an engine's NHMC, NOx, or CO emissions to exceed 2.0 times any of the applicable standards or an engine's PM emissions to exceed a threshold of the applicable standard plus 0.02 g/bhp-hr.

(10.2.2) Slow Response: The OBD system shall detect a malfunction prior to any failure or deterioration in the capability of the VVT system to achieve the commanded valve timing and/or control within a manufacturer-specified time that would cause an engine's NHMC, NOx, or CO emissions to exceed 2.0 times any of the applicable standards or an engine's PM emissions to exceed a threshold of the applicable standard plus 0.02 g/bhp-hr.

(10.2.3) For engines in which no failure or deterioration of the VVT system could result in an engine's emissions exceeding the thresholds of sections (e)(10.2.1) or (10.2.2), the OBD system shall detect a malfunction of the VVT system when proper functional response of the system to computer commands does not occur.

(10.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for VVT system malfunctions identified in section (e)(10.2) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (e)(10.2) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(10.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(11) Cold Start Emission Reduction Strategy Monitoring

(11.1) Requirement:

(11.1.1) For all 2013 and subsequent model year engines that incorporate a specific engine control strategy to reduce cold start emissions, the OBD system shall monitor the strategy to verify that it achieves the desired effect (e.g., to achieve accelerated catalyst light-off temperature) and monitor the commanded elements/components for proper function (e.g., injection timing, increased engine idle speed, increased engine load via intake or

exhaust throttle activation) while the control strategy is active to ensure proper operation of the control strategy.

(11.1.2) For an element/component associated with the cold start emission reduction control strategy under section (e)(11) that is also required to be monitored elsewhere in section (e) or (g) (e.g., fuel injection timing), the manufacturer shall use different diagnostics to distinguish faults detected under section (e)(11) (i.e., faults associated with the cold start strategy) from faults detected under sections other than section (e)(11) (i.e., faults not associated with the cold start strategy).

(11.2) Malfunction Criteria: The OBD system shall, to the extent feasible, detect a malfunction if either of the following occurs:

(11.2.1) Any single commanded element/component does not properly respond to the commanded action while the cold start strategy is active. For purposes of this section, "properly respond" is defined as when the element responds:

(A) by a robustly detectable amount by the monitor; and

(B) in the direction of the desired command; and

(C) above and beyond what the element/component would achieve on start-up without the cold start strategy active (e.g., if the cold start strategy commands a higher idle engine speed, a fault must be detected if there is no detectable amount of engine speed increase above what the system would achieve without the cold start strategy active);

(11.2.2) Any failure or deterioration of the cold start emission reduction control strategy that would cause an engine's NMHC, NOx, or CO emissions to exceed 2.0 times the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr.

(11.2.3) For section (e)(11.2.2), to the extent feasible (without adding hardware for this purpose), the OBD system shall monitor the ability of the system to achieve the desired effect (e.g., strategies used to accelerate catalyst light-off by increasing catalyst inlet temperature shall verify the catalyst inlet temperature actually achieves the desired temperatures within an Executive Officer approved time interval after starting the engine) for failures that cause emissions to exceed the applicable emission levels specified in section (e)(11.2.2). For strategies where it is not feasible to be monitored as a system, the OBD system shall monitor the individual elements/components (e.g., increased engine speed, increased engine load from restricting an exhaust throttle) for failures that cause emissions to exceed the applicable emission levels specified in section (e)(11.2.2).

(11.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(11.2) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(11.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(f) *Monitoring Requirements for Gasoline/Spark-Ignited Engines.*

(1) Fuel System Monitoring

(1.1) Requirement: The OBD system shall monitor the fuel delivery system to determine its ability to provide compliance with applicable standards.

(1.2) Malfunction Criteria:

(1.2.1) The OBD system shall detect a malfunction of the fuel delivery system when:

(A) The fuel delivery system is unable to maintain an engine's emissions at or below 1.5 times the applicable standards; or

(B) If equipped, the feedback control based on a secondary oxygen or exhaust gas sensor is unable to maintain an engine's emissions (except as a result of a malfunction specified in section (f)(1.2.1)(C)) at or below 1.5 times any of the applicable standards; or

(C) For 2014 and subsequent model year engines, an air-fuel ratio cylinder imbalance (e.g., the air-fuel ratio in one or more cylinders is different than the other cylinders due to a cylinder specific malfunction such as an intake manifold leak at a particular cylinder, fuel injector problem, an individual cylinder EGR runner flow delivery problem, an individual variable cam lift malfunction such that an individual cylinder is operating on the wrong cam lift profile, or other similar problems) occurs in one or more cylinders such that the fuel delivery system is unable to maintain an engine's emissions at or below: 3.0 times the applicable standards for the 2014 through 2016 model years; and 1.5 times the applicable FTP standards for all 2017 and subsequent model year engines.

(1.2.2) Except as provided for in section (f)(1.2.3) below, if the engine is equipped with adaptive feedback control, the OBD system shall detect a malfunction when the adaptive feedback control has used up all of the adjustment allowed by the manufacturer.

(1.2.3) If the engine is equipped with feedback control that is based on a secondary oxygen (or equivalent) sensor, the OBD system is not required to detect a malfunction of the fuel system solely when the feedback control based on a secondary oxygen sensor has used up all of the adjustment allowed by the manufacturer. However, if a failure or deterioration results in engine emissions that exceed the malfunction criteria in section (f)(1.2.1)(B), the OBD system is required to detect a malfunction.

(1.2.4) The OBD system shall detect a malfunction whenever the fuel control system fails to enter closed-loop operation within an Executive Officer-approved time interval after engine start. Executive Officer approval of the

time interval shall be granted upon determining that the data and/or engineering evaluation submitted by the manufacturer supports the specified times.

(1.2.5) For engines that employ engine shutoff strategies that do not require the vehicle operator to restart the engine to continue driving (e.g., hybrid bus with engine shutoff at idle), the OBD system shall detect whenever the fuel control system fails to enter closed-loop operation within an Executive Officer-approved time interval after an engine restart. Executive Officer approval of the time interval shall be granted upon determining that the data and/or engineering evaluation submitted by the manufacturer supports the specified times.

(1.3) Monitoring Conditions:

(1.3.1) Except as provided in section (f)(1.3.5), the OBD system shall monitor continuously for malfunctions identified in sections (f)(1.2.1)(A), (f)(1.2.1)(B), and (f)(1.2.2) (i.e., fuel delivery system, secondary feedback control, adaptive feedback control).

(1.3.2) Manufacturers shall define monitoring conditions for malfunctions identified in section (f)(1.2.1)(C) (i.e., air-fuel ratio cylinder imbalance malfunctions) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(1.3.3) Manufacturers shall define monitoring conditions for malfunctions identified in section (f)(1.2.4) in accordance with sections (d)(3.1).

(1.3.4) Manufacturers shall define monitoring conditions for malfunctions identified in section (f)(1.2.5) in accordance with sections (d)(3.1) with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2).

(1.3.5) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions (e.g., for temporary introduction of large amounts of purge vapor). The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that which is technically necessary.

(1.4) MIL Illumination and Fault Code Storage: For malfunctions described under section (f)(1.2.1)(C) (i.e., air-fuel ratio cylinder imbalance malfunctions), general requirements for MIL illumination and fault code storage are set forth in section (d)(2). For all other fuel system malfunctions, the MIL illumination and fault code storage requirements are set forth in sections (f)(1.4.1) through (1.4.6) below.

(1.4.1) A pending fault code shall be stored immediately upon the fuel system exceeding the malfunction criteria established pursuant to section (f)(1.2).

(1.4.2) Except as provided below, if a pending fault code is stored, the OBD system shall immediately illuminate the MIL and store a confirmed fault code if a malfunction is again detected during either of the following two events: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle; or (b) on the next driving cycle in which similar conditions (see section (c)) to those that occurred when the pending fault code was stored are encountered.

(1.4.3) The pending fault code may be erased at the end of the next driving cycle in which similar conditions have been encountered without an exceedance of the specified fuel system malfunction criteria. The pending code may also be erased if similar conditions are not encountered during the 80 driving cycles immediately after the initial detection of a malfunction for which the pending code was set.

(1.4.4) Storage of freeze frame conditions.

(A) The OBD system shall store and erase freeze frame conditions either in conjunction with storing and erasing a pending fault code or in conjunction with storing and erasing a confirmed fault code.

(B) If freeze frame conditions are stored for a malfunction other than a misfire (see section (f)(2)) or fuel system malfunction when a fault code is stored as specified in section (f)(1.4.1) or (f)(1.4.2) above, the stored freeze frame information shall be replaced with freeze frame information regarding the fuel system malfunction.

(1.4.5) Storage of fuel system conditions for determining similar conditions of operation.

(A) Upon detection of a fuel system malfunction under section (f)(1.2), the OBD system shall store the engine speed, load, and warm-up status of the first fuel system malfunction that resulted in the storage of the pending fault code.

(B) For fuel system faults detected using feedback control that is based on a secondary oxygen (or equivalent) sensor, the manufacturer may request Executive Officer approval to use an alternate definition of similar conditions in lieu of the definition specified in section (c). The Executive Officer shall approve the alternate definition upon the manufacturer providing data or analysis demonstrating that the alternate definition provides for equivalent robustness in detection of fuel system faults that vary in severity depending on engine speed, load, and/or warm-up status.

(1.4.6) Extinguishing the MIL. The MIL may be extinguished after three sequential driving cycles in which similar conditions have been encountered without a malfunction of the fuel system.

(2) Misfire Monitoring

(2.1) Requirement:

(2.1.1) The OBD system shall monitor the engine for misfire causing catalyst damage and misfire causing excess emissions.

(2.1.2) The OBD system shall identify the specific cylinder that is experiencing misfire. Manufacturers may request Executive Officer approval to store a general misfire fault code instead of a cylinder specific fault code under certain operating conditions. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that the misfiring cylinder cannot be reliably identified when the conditions occur.

(2.1.3) If more than one cylinder is misfiring, a separate fault code shall be stored indicating that multiple cylinders are misfiring except as allowed below. When identifying multiple cylinder misfire, the OBD system is not required to also identify each of the misfiring cylinders individually through separate fault codes. If more than 90 percent of the detected misfires occur in a single cylinder, the OBD system may elect to store the appropriate fault code indicating the specific misfiring cylinder in lieu of the multiple cylinder misfire fault code. If, however, two or more cylinders individually have more than 10 percent of the total number of detected misfires, a multiple cylinder fault code must be stored.

(2.2) Malfunction Criteria: The OBD system shall detect a misfire malfunction pursuant to the following:

(2.2.1) Misfire causing catalyst damage:

(A) Manufacturers shall determine the percentage of misfire evaluated in 200 revolution increments for each engine speed and load condition that would result in a temperature that causes catalyst damage. The manufacturer shall submit documentation to support this percentage of misfire as required in section (j)(2.5). For every engine speed and load condition that this percentage of misfire is determined to be lower than five percent, the manufacturer may set the malfunction criteria at five percent.

(B) Subject to Executive Officer approval, a manufacturer may employ a longer interval than 200 revolutions but only for determining, on a given driving cycle, the first misfire exceedance as provided in section (f)(2.4.1)(A) below. Executive Officer approval shall be granted upon determining that the manufacturer has submitted data and/or an engineering evaluation that

demonstrate that catalyst damage would not occur due to unacceptably high catalyst temperatures before the interval has elapsed.

(C) A misfire malfunction shall be detected if the percentage of misfire established in section (f)(2.2.1)(A) is exceeded. For multiple cylinder misfire situations that result in a misfire rate greater than or equal to 50 percent, the OBD system shall only be required to detect a misfire malfunction for situations that are caused by a single component failure.

(D) For purposes of establishing the temperature at which catalyst damage occurs as required in section (f)(2.2.1)(A), manufacturers may not define catalyst damage at a temperature more severe than what the catalyst system could be operated at for 10 consecutive hours and still meet the applicable standards.

(2.2.2) Misfire causing emissions to exceed 1.5 times the applicable standards:

(A) Manufacturers shall determine the percentage of misfire evaluated in 1000 revolution increments that would cause emissions from an emission durability demonstration engine to exceed 1.5 times any of the applicable standards if the percentage of misfire were present from the beginning of the test. To establish this percentage of misfire, the manufacturer shall utilize misfire events occurring at equally spaced, complete engine cycle intervals, across randomly selected cylinders throughout each 1000-revolution increment. If this percentage of misfire is determined to be lower than one percent, the manufacturer may set the malfunction criteria at one percent.

(B) Subject to Executive Officer approval, a manufacturer may employ other revolution increments. The Executive Officer shall grant approval upon determining that the manufacturer has demonstrated that the strategy would be equally effective and timely in detecting misfire.

(C) A malfunction shall be detected if the percentage of misfire established in section (f)(2.2.2)(A) is exceeded regardless of the pattern of misfire events (e.g., random, equally spaced, continuous).

(2.3) Monitoring Conditions:

(2.3.1) The OBD system shall continuously monitor for misfire under the following conditions:

(A) Except as provided for in section (f)(2.3.6) below, from no later than the end of the second crankshaft revolution after engine start,

(B) While under positive torque conditions during the rise time and settling time for engine speed to reach the desired idle engine speed at engine start-up (i.e., "flare-up" and "flare-down"), and

(C) Under all positive torque engine speeds and load conditions except within the following range: the engine operating region bound by the positive

torque line (i.e., engine load with the transmission in neutral), and the two following engine operating points: an engine speed of 3000 rpm with the engine load at the positive torque line, and the redline engine speed (defined in section (c)) with the engine's manifold vacuum at four inches of mercury lower than that at the positive torque line.

(2.3.2) If a monitoring system cannot detect all misfire patterns under all required engine speed and load conditions as required in section (f)(2.3.1) above, the manufacturer may request Executive Officer approval to accept the monitoring system. In evaluating the manufacturer's request, the Executive Officer shall consider the following factors: the magnitude of the region(s) in which misfire detection is limited, the degree to which misfire detection is limited in the region(s) (i.e., the probability of detection of misfire events), the frequency with which said region(s) are expected to be encountered in-use, the type of misfire patterns for which misfire detection is troublesome, and demonstration that the monitoring technology employed is not inherently incapable of detecting misfire under required conditions (i.e., compliance can be achieved on other engines). The evaluation shall be based on the following misfire patterns: equally spaced misfire occurring on randomly selected cylinders, single cylinder continuous misfire, and paired cylinder (cylinders firing at the same crank angle) continuous misfire.

(2.3.3) A manufacturer may request Executive Officer approval of a monitoring system that has reduced misfire detection capability during the portion of the first 1000 revolutions after engine start that a cold start emission reduction strategy that reduces engine torque (e.g., spark retard strategies) is active. The Executive Officer shall approve the request upon determining that the manufacturer has demonstrated that the probability of detection is greater than or equal to 75 percent during the worst case condition (i.e., lowest generated torque) for a vehicle operated continuously at idle (park/neutral idle) on a cold start between 50 and 86 degrees Fahrenheit and that the technology cannot reliably detect a higher percentage of the misfire events during the conditions.

(2.3.4) A manufacturer may request Executive Officer approval to disable misfire monitoring or employ an alternate malfunction criterion when misfire cannot be distinguished from other effects.

(A) Upon determining that the manufacturer has presented documentation that demonstrates the disablement interval or period of use of an alternate malfunction criterion is limited only to that necessary for avoiding false detection, the Executive Officer shall approve the disablement or use of the alternate malfunction criterion for conditions involving:

(i) rough road,

(ii) fuel cut,

(iii) gear changes for manual transmission vehicles,

(iv) traction control or other vehicle stability control activation such as anti-lock braking or other engine torque modifications to enhance vehicle stability,

(v) off-board control or intrusive activation of vehicle components or diagnostics during service or assembly plant testing,

(vi) portions of intrusive evaporative system or EGR diagnostics that can significantly affect engine stability (i.e., while the purge valve is open during the vacuum pull-down of a evaporative system leak check but not while the purge valve is closed and the evaporative system is sealed or while an EGR diagnostic causes the EGR valve to be intrusively cycled on and off during positive torque conditions), or

(vii) engine speed, load, or torque transients due to throttle movements more rapid than occurs over the FTP cycle for the worst case engine within each engine family.

(B) Additionally, the Executive Officer will approve a manufacturer's request in accordance with sections (g)(5.3), (g)(5.4), and (g)(5.6) to disable misfire monitoring when the fuel level is 15 percent or less of the nominal capacity of the fuel tank, when PTO units are active, or while engine coolant temperature is below 20 degrees Fahrenheit. The Executive Officer will approve a request to continue disablement on engine starts when engine coolant temperature is below 20 degrees Fahrenheit at engine start until engine coolant temperature exceeds 70 degrees Fahrenheit.

(C) In general, the Executive Officer shall not approve disablement for conditions involving normal air conditioning compressor cycling from on-to-off or off-to-on, automatic transmission gear shifts (except for shifts occurring during wide open throttle operation), transitions from idle to off-idle, normal engine speed or load changes that occur during the engine speed rise time and settling time (i.e., "flare-up" and "flare-down") immediately after engine starting without any vehicle operator-induced actions (e.g., throttle stabs), or excess acceleration (except for acceleration rates that exceed the maximum acceleration rate obtainable at wide open throttle while the vehicle is in gear due to abnormal conditions such as slipping of a clutch).

(D) The Executive Officer may approve misfire monitoring disablement or use of an alternate malfunction criterion for any other condition on a case by case basis upon determining that the manufacturer has demonstrated that the request is based on an unusual or unforeseen circumstance and that it is applying the best available computer and monitoring technology.

(2.3.5) For engines with more than eight cylinders that cannot meet the requirements of section (f)(2.3.1), a manufacturer may request Executive Officer approval to use alternative misfire monitoring conditions. The Executive Officer shall approve the request upon determining that the

manufacturer has submitted data and/or an engineering evaluation that demonstrate that misfire detection throughout the required operating region cannot be achieved when employing proven monitoring technology (i.e., a technology that provides for compliance with these requirements on other engines) and provided misfire is detected to the fullest extent permitted by the technology. However, the Executive Officer may not grant the request if the misfire detection system is unable to monitor during all positive torque operating conditions encountered during an FTP cycle.

(2.3.6) For engines that employ engine shutoff strategies that do not require the vehicle operator to restart the engine to continue driving (e.g., hybrid bus with engine shutoff at idle), the OBD system shall monitor for misfire from no later than the end of the second crankshaft revolution after engine fueling begins for the initial start and after each time fueling resumes.

(2.4) MIL Illumination and Fault Code Storage:

(2.4.1) Misfire causing catalyst damage. Upon detection of the percentage of misfire specified in section (f)(2.2.1) above, the following criteria shall apply for MIL illumination and fault code storage:

(A) Pending fault codes

(i) A pending fault code shall be stored immediately if, during a single driving cycle, the specified percentage of misfire is exceeded three times when operating in the positive torque region encountered during an FTP cycle or is exceeded on a single occasion when operating at any other engine speed and load condition in the positive torque region defined in section (f)(2.3.1).

(ii) Immediately after a pending fault code is stored as specified in section (f)(2.4.1)(A)(i) above, the MIL shall blink once per second at all times while misfire is occurring during the driving cycle.

a. The MIL may be extinguished during those times when misfire is not occurring during the driving cycle.

b. If, at the time a misfire malfunction occurs, the MIL is already illuminated for a malfunction other than misfire, the MIL shall blink as previously specified in section (f)(2.4.1)(A)(ii) while misfire is occurring. If misfiring ceases, the MIL shall stop blinking but remain illuminated as required by the other malfunction.

(B) Confirmed fault codes

(i) If a pending fault code for exceeding the percentage of misfire set forth in section (f)(2.2.1) is stored, the OBD system shall immediately store a confirmed fault code if the percentage of misfire specified in section (f)(2.2.1) is again exceeded one or more times during either: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle;

or (b) on the next driving cycle in which similar conditions (see section (c)) to the engine conditions that occurred when the pending fault code was stored are encountered.

(ii) If a pending fault code for exceeding the percentage of misfire set forth in section (f)(2.2.2) is stored from a previous driving cycle, the OBD system shall immediately store a confirmed fault code if the percentage of misfire specified in section (f)(2.2.1) is exceeded one or more times regardless of the conditions encountered.

(iii) Upon storage of a confirmed fault code, the MIL shall blink as specified in subparagraph (f)(2.4.1)(A)(ii) above as long as misfire is occurring and the MIL shall remain continuously illuminated if the misfiring ceases.

(C) Erasure of pending fault codes

Pending fault codes shall be erased at the end of the next driving cycle in which similar conditions to the engine conditions that occurred when the pending fault code was stored have been encountered without any exceedance of the specified percentage of misfire. The pending code may also be erased if similar driving conditions are not encountered during the next 80 driving cycles subsequent to the initial detection of a malfunction.

(D) Exemptions for engines with fuel shutoff and default fuel control. Notwithstanding sections (f)(2.4.1)(A) and (B) above, in engines that provide for fuel shutoff and default fuel control to prevent over fueling during catalyst damage misfire conditions, the MIL is not required to blink. Instead, the MIL may illuminate continuously in accordance with the requirements for continuous MIL illumination in sections (f)(2.4.1)(B)(iii) above upon detection of misfire, provided that the fuel shutoff and default control are activated as soon as misfire is detected. Fuel shutoff and default fuel control may be deactivated only to permit fueling outside of the misfire range. Manufacturers may also periodically, but not more than once every 30 seconds, deactivate fuel shutoff and default fuel control to determine if the specified catalyst damage percentage of misfire is still being exceeded. Normal fueling and fuel control may be resumed if the specified catalyst damage percentage of misfire is no longer being exceeded.

(E) Manufacturers may request Executive Officer approval of strategies that continuously illuminate the MIL in lieu of blinking the MIL during extreme catalyst damage misfire conditions (i.e., catalyst damage misfire occurring at all engine speeds and loads). Executive Officer approval shall be granted upon determining that the manufacturer employs the strategy only when catalyst damage misfire levels cannot be avoided during reasonable driving conditions and the manufacturer has demonstrated that the strategy will encourage operation of the vehicle in conditions that will minimize catalyst damage (e.g., at low engine speeds and loads).

(2.4.2) Misfire causing emissions to exceed 1.5 times the FTP standards. Upon detection of the percentage of misfire specified in section (f)(2.2.2), the following criteria shall apply for MIL illumination and fault code storage:

(A) Misfire within the first 1000 revolutions after engine start.

(i) A pending fault code shall be stored no later than after the first exceedance of the specified percentage of misfire during a single driving cycle if the exceedance occurs within the first 1000 revolutions after engine start (defined in section (c)) during which misfire detection is active.

(ii) If a pending fault code is stored, the OBD system shall illuminate the MIL and store a confirmed fault code within 10 seconds if an exceedance of the specified percentage of misfire is again detected in the first 1000 revolutions during any subsequent driving cycle, regardless of the conditions encountered during the driving cycle.

(iii) The pending fault code shall be erased at the end of the next driving cycle in which similar conditions to the engine conditions that occurred when the pending fault code was stored have been encountered without an exceedance of the specified percentage of misfire. The pending code may also be erased if similar conditions are not encountered during the next 80 driving cycles immediately following the initial detection of the malfunction.

(B) Exceedances after the first 1000 revolutions after engine start.

(i) A pending fault code shall be stored no later than after the fourth exceedance of the percentage of misfire specified in section (f)(2.2.2) during a single driving cycle.

(ii) If a pending fault code is stored, the OBD system shall illuminate the MIL and store a confirmed fault code within 10 seconds if the percentage of misfire specified in section (f)(2.2.2) is again exceeded four times during: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle; or (b) on the next driving cycle in which similar conditions (see section (c)) to the engine conditions that occurred when the pending fault code was stored are encountered.

(iii) The pending fault code may be erased at the end of the next driving cycle in which similar conditions to the engine conditions that occurred when the pending fault code was stored have been encountered without an exceedance of the specified percentage of misfire. The pending code may also be erased if similar conditions are not encountered during the next 80 driving cycles immediately following initial detection of the malfunction.

(2.4.3) Storage of freeze frame conditions.

(A) The OBD system shall store and erase freeze frame conditions either in conjunction with storing and erasing a pending fault code or in conjunction with storing and erasing a confirmed fault code.

(B) If freeze frame conditions are stored for a malfunction other than a misfire or fuel system malfunction (see section (f)(1)) when a fault code is stored as specified in section (f)(2.4) above, the stored freeze frame information shall be replaced with freeze frame information regarding the misfire malfunction.

(2.4.4) Storage of misfire conditions for similar conditions determination. Upon detection of misfire under sections (f)(2.4.1) or (2.4.2), the OBD system shall store the following engine conditions: engine speed, load, and warm-up status of the first misfire event that resulted in the storage of the pending fault code.

(2.4.5) Extinguishing the MIL. The MIL may be extinguished after three sequential driving cycles in which similar conditions have been encountered without an exceedance of the specified percentage of misfire.

(3) Exhaust Gas Recirculation (EGR) System Monitoring

(3.1) Requirement: The OBD system shall monitor the EGR system on engines so-equipped for low and high flow rate malfunctions. The individual electronic components (e.g., actuators, valves, sensors) that are used in the EGR system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(3.2) Malfunction Criteria:

(3.2.1) The OBD system shall detect a malfunction of the EGR system prior to a decrease from the manufacturer's specified EGR flow rate that would cause an engine's emissions to exceed 1.5 times any of the applicable standards. For engines in which no failure or deterioration of the EGR system that causes a decrease in flow could result in an engine's emissions exceeding 1.5 times any of the applicable standards, the OBD system shall detect a malfunction when the system has no detectable amount of EGR flow.

(3.2.2) The OBD system shall detect a malfunction of the EGR system prior to an increase from the manufacturer's specified EGR flow rate that would cause an engine's emissions to exceed 1.5 times any of the applicable standards. For engines in which no failure or deterioration of the EGR system that causes an increase in flow could result in an engine's emissions exceeding 1.5 times any of the applicable standards, the OBD system shall detect a malfunction when the system has reached its control limits such that it cannot reduce EGR flow.

(3.3) Monitoring Conditions:

(3.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in section (f)(3.2) (i.e., flow rate) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (f)(3.2) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(3.3.2) Manufacturers may request Executive Officer approval to temporarily disable the EGR system check under conditions when monitoring may not be reliable (e.g., when freezing may affect performance of the system). The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a reliable check cannot be made when these conditions exist.

(3.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(4) Cold Start Emission Reduction Strategy Monitoring

(4.1) Requirement:

(4.1.1) If an engine incorporates a specific engine control strategy to reduce cold start emissions, the OBD system shall monitor the commanded elements/components for proper function (e.g., increased engine idle speed, mass air flow, commanded ignition timing retard), other than secondary air, while the control strategy is active to ensure proper operation of the control strategy. Secondary air systems shall be monitored under the provisions of section (f)(5).

(4.1.2) For an element/component associated with the cold start emission reduction control strategy under section (f)(4) that is also required to be monitored elsewhere in section (f) or (g) (e.g., fuel injection timing), the manufacturer shall use different diagnostics to distinguish faults detected under section (f)(4) (i.e., faults associated with the cold start strategy) from faults detected under sections other than section (f)(4) (i.e., faults not associated with the cold start strategy).

(4.2) Malfunction Criteria:

(4.2.1) For 2010 through 2012 model year engines:

(A) The OBD system shall detect a malfunction prior to any failure or deterioration of the individual elements/components associated with the cold start emission reduction control strategy that would cause an engine's emissions to exceed 1.5 times the applicable standards. Manufacturers shall:

(i) Establish the malfunction criteria based on data from one or more representative engine(s).

(ii) Provide an engineering evaluation for establishing the malfunction criteria for the remainder of the manufacturer's product line. The Executive Officer shall waive the evaluation requirement each year if, in the judgment of the Executive Officer, technological changes do not affect the previously determined malfunction criteria.

(B) For components where no failure or deterioration of the element/component used for the cold start emission reduction strategy could result in an engine's emissions exceeding 1.5 times the applicable standards, the individual element/component shall be monitored for proper functional response in accordance with the malfunction criteria in section (g)(3.2) while the control strategy is active.

(4.2.2) For 2013 and subsequent model year engines, the OBD system shall, to the extent feasible, detect a malfunction if either of the following occurs:

(A) Any single commanded element/component does not properly respond to the commanded action while the cold start strategy is active. For elements/components involving spark timing (e.g., retarded spark timing), the monitor may verify final commanded spark timing in lieu of verifying actual delivered spark timing. For purposes of this section, "properly respond" is defined as when the element responds:

(i) by a robustly detectable amount; and

(ii) in the direction of the desired command; and

(iii) above and beyond what the element/component would achieve on start-up without the cold start strategy active (e.g., if the cold start strategy commands a higher idle engine speed, a fault must be detected if there is no detectable amount of engine speed increase above what the system would achieve without the cold start strategy active);

(B) Any failure or deterioration of the cold start emission reduction control strategy that would cause an engine's emissions to be equal to or above 1.5 times the applicable standards. For this requirement, the OBD system shall either monitor the combined effect of the elements/components of the system as a whole (e.g., measuring air flow and modeling overall heat into the exhaust) or the individual elements/components (e.g., increased engine speed, commanded final spark timing) for failures that cause engine emissions to exceed 1.5 times the applicable standards.

(4.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (f)(4.2) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(4.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(5) Secondary Air System Monitoring

(5.1) Requirement:

(5.1.1) The OBD system on engines equipped with any form of secondary air delivery system shall monitor the proper functioning of the secondary air delivery system including all air switching valve(s). The individual electronic components (e.g., actuators, valves, sensors) in the secondary air system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(5.1.2) For purposes of section (f)(5), "air flow" is defined as the air flow delivered by the secondary air system to the exhaust system. For engines using secondary air systems with multiple air flow paths/distribution points, the air flow to each bank (i.e., a group of cylinders that share a common exhaust manifold, catalyst, and control sensor) shall be monitored in accordance with the malfunction criteria in section (f)(5.2) unless complete blocking of air delivery to one bank does not cause a measurable increase in emissions.

(5.1.3) For purposes of section (f)(5), "normal operation" is defined as the condition when the secondary air system is activated during catalyst and/or engine warm-up following engine start. "Normal operation" does not include the condition when the secondary air system is intrusively turned on solely for the purpose of monitoring.

(5.2) Malfunction Criteria:

(5.2.1) Except as provided in section (f)(5.2.3), the OBD system shall detect a secondary air system malfunction prior to a decrease from the manufacturer's specified air flow during normal operation that would cause an engine's emissions to exceed 1.5 times any of the applicable standards.

(5.2.2) Except as provided in section (f)(5.2.4), the OBD system shall detect a secondary air system malfunction prior to an increase from the manufacturer's specified air flow during normal operation that would cause an engine's emissions to exceed 1.5 times any of the applicable standards.

(5.2.3) For engines in which no deterioration or failure of the secondary air system that causes a decrease in air flow would result in an engine's emissions exceeding 1.5 times any of the applicable standards, the OBD system shall detect a malfunction when no detectable amount of air flow is delivered during normal operation.

(5.2.4) For 2016 and subsequent model year engines in which no deterioration or failure of the secondary air system that causes an increase in air flow

would result in an engine's emissions exceeding 1.5 times any of the applicable standards, the OBD system shall detect a malfunction when the secondary air system has reached its control limits such that it cannot reduce air flow during normal operation.

(5.3) Monitoring Conditions:

(5.3.1) Manufacturers shall define the monitoring conditions in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (f)(5.2) during normal operation of the secondary air system shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(5.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(6) Catalyst Monitoring

(6.1) Requirement: The OBD system shall monitor the catalyst system for proper conversion capability.

(6.2) Malfunction Criteria:

(6.2.1) The OBD system shall detect a catalyst system malfunction when the catalyst system's conversion capability decreases to the point that any of the following occurs:

(A) Non-Methane Hydrocarbon (NMHC) emissions exceed 1.75 times the applicable standards to which the engine has been certified.

(B) The average FTP test NMHC conversion efficiency of the monitored portion of the catalyst system falls below 50 percent (i.e., the cumulative NMHC emissions measured at the outlet of the monitored catalyst(s) are more than 50 percent of the cumulative engine-out emissions measured at the inlet of the catalyst(s)). With Executive Officer approval, manufacturers may use a conversion efficiency malfunction criteria of less than 50 percent if the catalyst system is designed such that the monitored portion of the catalyst system must be replaced along with an adjacent portion of the catalyst system sufficient to ensure that the total portion replaced will meet the 50 percent conversion efficiency criteria. Executive Officer approval shall be based on data and/or engineering evaluation demonstrating the conversion efficiency of the monitored portion and the total portion designed to be replaced, and the likelihood of the catalyst system design to ensure replacement of the monitored and adjacent portions of the catalyst system.

(C) Oxides of nitrogen (NOx) emissions exceed 1.75 times the applicable NOx standard to which the engine has been certified.

(6.2.2) For purposes of determining the catalyst system malfunction criteria in section (f)(6.2.1):

(A) The manufacturer shall use a catalyst system deteriorated to the malfunction criteria using methods established by the manufacturer to represent real world catalyst deterioration under normal and malfunctioning operating conditions.

(B) Except as provided below in section (f)(6.2.2)(C), the malfunction criteria shall be established by using a catalyst system with all monitored and unmonitored (downstream of the sensor utilized for catalyst monitoring) catalysts simultaneously deteriorated to the malfunction criteria.

(C) For engines using fuel shutoff to prevent over-fueling during misfire conditions (see section (f)(2.4.1)(D)), the malfunction criteria shall be established by using a catalyst system with all monitored catalysts simultaneously deteriorated to the malfunction criteria while unmonitored catalysts shall be deteriorated to the end of the engine's useful life.

(6.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (f)(6.2) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (f)(6.2) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(6.4) MIL Illumination and Fault Code Storage:

(6.4.1) General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(6.4.2) The monitoring method for the catalyst(s) shall be capable of detecting when a catalyst fault code has been cleared (except OBD system self-clearing), but the catalyst has not been replaced (e.g., catalyst overtemperature histogram approaches are not acceptable).

(7) Evaporative System Monitoring

(7.1) Requirement: The OBD system shall verify purge flow from the evaporative system and shall monitor the complete evaporative system, excluding the tubing and connections between the purge valve and the intake manifold, for vapor leaks to the atmosphere. Individual components of the evaporative system (e.g. valves, sensors) shall be monitored in accordance with the comprehensive components requirements in section (g)(3) (e.g., for circuit continuity, out of range values, rationality, proper functional response). Vehicles not subject to evaporative emission standards shall be exempt from monitoring of the evaporative system. For alternate-fueled engines subject to evaporative emission standards, manufacturers shall submit a monitoring plan to the Executive Officer for approval. The Executive Officer shall approve the

request upon determining that the manufacturer has submitted data and an engineering evaluation that demonstrate that the monitoring plan is as reliable and effective as the monitoring plan required for gasoline engines under section (f)(7).

(7.2) Malfunction Criteria:

(7.2.1) For purposes of section (f)(7), an "orifice" is defined as an O'Keefe Controls Co. precision metal "Type B" orifice with NPT connections with a diameter of the specified dimension (e.g., part number B-31-SS for a stainless steel 0.031 inch diameter orifice).

(7.2.2) The OBD system shall detect an evaporative system malfunction when any of the following conditions exist:

(A) No purge flow from the evaporative system to the engine can be detected by the OBD system; or

(B) The complete evaporative system contains a leak or leaks that cumulatively are greater than or equal to a leak caused by a 0.150 inch diameter orifice.

(7.2.3) A manufacturer may request the Executive Officer to revise the orifice size in section (f)(7.2.2)(B) if the most reliable monitoring method available cannot reliably detect a system leak of the magnitudes specified. The Executive Officer shall approve the request upon determining that the manufacturer has provided data and/or engineering analysis that demonstrate the need for the request.

(7.2.4) Upon request by the manufacturer and upon determining that the manufacturer has submitted data and/or engineering evaluation which support the request, the Executive Officer shall revise the orifice size in section (f)(7.2.2)(B) upward to exclude detection of leaks that cannot cause evaporative or running loss emissions to exceed 1.5 times the applicable evaporative emission standards.

(7.2.5) For engines that utilize more than one purge flow path (e.g., a turbo-charged engine with a low pressure purge line and a high pressure purge line), the OBD system shall verify the criteria of (f)(7.2.2)(A) (i.e., purge flow to the engine) for all purge flow paths. If a manufacturer demonstrates that blockage, leakage, or disconnection of one of the purge flow paths cannot cause a measurable emission increase during any reasonable in-use driving conditions, monitoring of that flow path is not required.

(7.3) Monitoring Conditions:

(7.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in section (f)(7.2.2)(A) (i.e., purge flow) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(7.3.2) Manufacturers shall define the monitoring conditions for malfunctions identified in section (f)(7.2.2)(B) (i.e., 0.150 inch leak detection) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (f)(7.2.2)(B) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(7.3.3) Manufacturers may disable or abort an evaporative system monitor when the fuel tank level is over 85 percent of nominal tank capacity or during a refueling event.

(7.3.4) Manufacturers may request Executive Officer approval to execute the evaporative system monitor only on driving cycles determined by the manufacturer to be cold starts if the condition is needed to ensure reliable monitoring. The Executive Officer shall approve the request upon determining that data and/or an engineering evaluation submitted by the manufacturer demonstrate that a reliable check can only be made on driving cycles when the cold start criteria are satisfied. However, in making a decision, the Executive Officer will not approve conditions that exclude engine starts from being considered as cold starts solely on the basis that ambient temperature exceeds (i.e., indicates a higher temperature than) engine coolant temperature at engine start.

(7.3.5) Manufacturers may temporarily disable the evaporative purge system to perform an evaporative system leak check.

(7.4) MIL Illumination and Fault Code Storage:

(7.4.1) Except as provided below for fuel cap leaks, general requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(7.4.2) If the OBD system is capable of discerning that a system leak is being caused by a missing or improperly secured fuel cap:

(A) The manufacturer is not required to illuminate the MIL or store a fault code if the vehicle is equipped with an alternative indicator for notifying the vehicle operator of the malfunction. The alternative indicator shall be of sufficient illumination and location to be readily visible under all lighting conditions.

(B) If the vehicle is not equipped with an alternative indicator and the MIL illuminates, the MIL may be extinguished and the corresponding fault codes erased once the OBD system has verified that the fuel cap has been securely fastened and the MIL has not been illuminated for any other type of malfunction.

(C) The Executive Officer may approve other strategies that provide equivalent assurance that a vehicle operator will be promptly notified of a missing or improperly secured fuel cap and that corrective action will be undertaken.

(8) Exhaust Gas Sensor Monitoring

(8.1) Requirement:

(8.1.1) The OBD system shall monitor the output signal, response rate, and any other parameter which can affect emissions of all primary (fuel control) oxygen sensors (conventional switching sensors and wide range or universal sensors) for malfunction.

(8.1.2) The OBD system shall also monitor all secondary oxygen sensors (those used for fuel trim control or as a monitoring device) for proper output signal, activity, and response rate.

(8.1.3) For engines equipped with heated oxygen sensors, the OBD system shall monitor the heater for proper performance.

(8.1.4) For other types of sensors (e.g., hydrocarbon sensors, NOx sensors), the manufacturer shall submit a monitoring plan to the Executive Officer for approval. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and an engineering evaluation that demonstrate that the monitoring plan is as reliable and effective as the monitoring plan required for conventional sensors under section (f)(8).

(8.2) Malfunction Criteria:

(8.2.1) Primary Sensors:

(A) The OBD system shall detect a malfunction prior to any failure or deterioration of the oxygen sensor output voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) (including drift or bias corrected for by secondary sensors) that would cause an engine's emissions to exceed 1.5 times any of the applicable standards. For response rate (see section (c)), the OBD system shall detect asymmetric malfunctions (i.e., malfunctions that primarily affect only the lean-to-rich response rate or only the rich-to-lean response rate) and symmetric malfunctions (i.e., malfunctions that affect both the lean-to-rich and rich-to-lean response rates). As defined in section (c), response rate includes delays in the sensor to initially react to a change in exhaust gas composition as well as delays during the transition from a rich-to-lean (or lean-to-rich) sensor output. For 2013 and subsequent model year engines, the manufacturer shall submit data and/or engineering analysis to demonstrate that the calibration method used ensures proper detection of all symmetric and asymmetric response rate malfunctions as part of the certification application.

(B) The OBD system shall detect malfunctions of the oxygen sensor caused by either a lack of circuit continuity or out-of-range values.

(C) The OBD system shall detect a malfunction of the oxygen sensor when a sensor failure or deterioration causes the fuel system to stop using that sensor as a feedback input (e.g., causes default or open-loop operation) or causes the fuel system to fail to enter closed-loop operation within a manufacturer-specified time interval.

(D) The OBD system shall detect a malfunction of the oxygen sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst monitoring).

(8.2.2) Secondary Sensors:

(A) The OBD system shall detect a malfunction prior to any failure or deterioration of the oxygen sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's emissions to exceed 1.5 times any of the applicable standards.

(B) The OBD system shall detect malfunctions of the oxygen sensor caused by a lack of circuit continuity.

(C) Sufficient sensor performance for other monitors.

(i) The OBD system shall detect a malfunction of the oxygen sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst monitoring). For this requirement, "sufficient" is defined as the capability of the worst performing acceptable sensor to detect the best performing unacceptable other monitored system or component (e.g., catalyst).

(ii) For systems where it is not technically feasible to satisfy the criteria of section (f)(8.2.2)(C)(i) completely, the OBD system shall, at a minimum, detect a slow rich-to-lean response malfunction during a fuel shut-off event (e.g., deceleration fuel cut event) on all 2013 and subsequent model year engines. The rich-to-lean response check shall monitor both the sensor response time from a rich condition (e.g., 0.7 Volts) prior to the start of fuel shut-off to a lean condition (e.g., 0.1 Volts) expected during fuel shut-off conditions and the sensor transition time in the intermediate sensor range (e.g., from 0.55 Volts to 0.3 Volts).

(iii) Additionally, for systems where it is not technically feasible to satisfy the criteria in section (f)(8.2.2)(C)(i), prior to certification of 2013 model year engines, the manufacturer must submit a comprehensive plan to the Executive Officer demonstrating the manufacturer's efforts to minimize any gap remaining between the worst performing acceptable sensor and a sufficient sensor. The plan should include quantification of the gap and supporting documentation for efforts to close the gap including sensor monitoring improvements, other system component monitor improvements (e.g., changes to make the catalyst monitor less

sensitive to oxygen sensor response), and sensor specification changes, if any. The Executive Officer shall approve the plan upon determining the submitted information supports the necessity of the gap and the plan demonstrates that the manufacturer is taking reasonable efforts to minimize or eliminate the gap in a timely manner.

(D) The OBD system shall detect malfunctions of the oxygen sensor caused by out-of-range values.

(E) The OBD system shall detect a malfunction of the oxygen sensor when a sensor failure or deterioration causes the fuel system (e.g., fuel control) to stop using that sensor as a feedback input (e.g., causes default or open-loop operation).

(8.2.3) Sensor Heaters:

(A) The OBD system shall detect a malfunction of the heater performance when the current or voltage drop in the heater circuit is no longer within the manufacturer's specified limits for normal operation (i.e., within the criteria required to be met by the component vendor for heater circuit performance at high mileage). Subject to Executive Officer approval, other malfunction criteria for heater performance malfunctions may be used upon the Executive Officer determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate the monitoring reliability and timeliness to be equivalent to the stated criteria in section (f)(8.2.3)(A).

(B) The OBD system shall detect malfunctions of the heater circuit including open or short circuits that conflict with the commanded state of the heater (e.g., shorted to 12 Volts when commanded to 0 Volts (ground)).

(8.3) Monitoring Conditions:

(8.3.1) Primary Sensors

(A) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (f)(8.2.1)(A) and (D) (e.g., proper response rate) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (f)(8.2.1)(A) and (D) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(B) Except as provided in section (f)(8.3.1)(C), monitoring for malfunctions identified in sections (f)(8.2.1)(B) and (C) (i.e., circuit continuity, out-of-range, and open-loop malfunctions) shall be conducted continuously.

(C) A manufacturer may request Executive Officer approval to disable continuous exhaust gas sensor monitoring when an exhaust gas sensor malfunction cannot be distinguished from other effects (e.g., disable out-of-range low monitoring during fuel cut conditions). The Executive Officer shall approve the disablement upon determining that the manufacturer has

submitted test data and/or documentation that demonstrate a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false detection.

(8.3.2) Secondary Sensors

(A) Manufacturers shall define monitoring conditions for malfunctions identified in sections (f)(8.2.2)(A) and (C) (e.g., proper sensor activity) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For all 2013 and subsequent model year engines meeting the monitoring requirements of section (f)(8.2.2)(C)(i) or (ii), for purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (f)(8.2.2)(A) and (C) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(B) Except as provided in section (f)(8.3.2)(C), monitoring for malfunctions identified in sections (f)(8.2.2)(B), (D), and (E) (i.e., open circuit, out-of-range malfunctions, open-loop malfunctions) shall be conducted continuously.

(C) A manufacturer may request Executive Officer approval to disable continuous exhaust gas sensor monitoring when an oxygen sensor malfunction cannot be distinguished from other effects (e.g., disable out-of-range low monitoring during fuel cut conditions). The Executive Officer shall approve the disablement upon determining that the manufacturer has submitted test data and/or documentation that demonstrate a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false detection.

(8.3.3) Sensor Heaters

(A) Manufacturers shall define monitoring conditions for malfunctions identified in section (f)(8.2.3)(A) (i.e., sensor heater performance) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(B) Monitoring for malfunctions identified in section (f)(8.2.3)(B) (i.e., circuit malfunctions) shall be conducted continuously.

(8.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2). To the extent feasible, the OBD system shall separately detect lack of circuit continuity and out-of-range faults as required under sections (f)(8.2.1)(B), (f)(8.2.2)(B), and (f)(8.2.2)(D) and store different fault codes for each distinct malfunction (e.g., out-of-range low, out-of-range high, open circuit). Manufacturers are not required to store separate fault codes for lack of circuit continuity faults that cannot be distinguished from other out-of-range circuit faults.

(9) Variable Valve Timing and/or Control (VVT) System Monitoring

(9.1) Requirement: The OBD system shall monitor the VVT system on engines so-equipped for target error and slow response malfunctions. The individual electronic components (e.g., actuators, valves, sensors) that are used in the VVT system shall be monitored in accordance with the comprehensive components requirements in section (g)(3).

(9.2) Malfunction Criteria:

(9.2.1) Target Error: The OBD system shall detect a malfunction prior to any failure or deterioration in the capability of the VVT system to achieve the commanded valve timing and/or control within a crank angle and/or lift tolerance that would cause an engine's emissions to exceed 1.5 times any of the applicable standards.

(9.2.2) Slow Response: The OBD system shall detect a malfunction prior to any failure or deterioration in the capability of the VVT system to achieve the commanded valve timing and/or control within a manufacturer-specified time that would cause an engine's emissions to exceed 1.5 times any of the applicable standards for gasoline engines.

(9.2.3) For engines in which no failure or deterioration of the VVT system could result in an engine's emissions exceeding 1.5 times any of the applicable standards, the OBD system shall detect a malfunction of the VVT system when proper functional response of the system to computer commands does not occur.

(9.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for VVT system malfunctions identified in section (f)(9.2) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (f)(9.2) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(9.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(g) *Monitoring Requirements For All Engines.*

(1) Engine Cooling System Monitoring

(1.1) Requirement:

(1.1.1) The OBD system shall monitor the thermostat on engines so-equipped for proper operation.

(1.1.2) The OBD system shall monitor the engine coolant temperature (ECT) sensor for circuit continuity, out-of-range values, and rationality faults.

(1.1.3) For engines that use a system other than the cooling system and ECT sensor (e.g., oil temperature, cylinder head temperature) for an indication of engine operating temperature for emission control purposes (e.g., to modify spark or fuel injection timing or quantity), the manufacturer shall submit a monitoring plan to the Executive Officer for approval. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and an engineering evaluation that demonstrate that the monitoring plan is as reliable and effective as the monitoring required for the engine cooling system under section (g)(1).

(1.2) Malfunction Criteria:

(1.2.1) Thermostat

(A) The OBD system shall detect a thermostat malfunction if, within an Executive Officer-approved time interval after engine start, any of the following conditions occur:

(i) The coolant temperature does not reach the highest temperature required by the OBD system to enable other diagnostics;

(ii) The coolant temperature does not reach a warmed-up temperature within 20 degrees Fahrenheit of the manufacturer's nominal thermostat regulating temperature. Subject to Executive Officer approval, a manufacturer may utilize lower temperatures for this criterion upon the Executive Officer determining that the manufacturer has demonstrated that the fuel, spark timing, and/or other coolant temperature-based modifications to the engine control strategies would not cause an emission increase of 50 or more percent of any of the applicable standards (e.g., 50 degree Fahrenheit emission test).

(B) For 2016 and subsequent model year engines, the OBD system shall detect a thermostat fault if, after the coolant temperature has reached the temperatures indicated in sections (g)(1.2.1)(A)(i) and (ii), the coolant temperature drops below the temperature indicated in section (g)(1.2.1)(A)(i).

(C) Executive Officer approval of the time interval after engine start under section (g)(1.2.1)(A) above shall be granted upon determining that the data and/or engineering evaluation submitted by the manufacturer supports the specified times.

(D) For monitoring of malfunctions under section (g)(1.2.1)(A), with Executive Officer approval, a manufacturer may use alternate malfunction criteria and/or monitoring conditions (see section (g)(1.3)) that are a function of temperature at engine start on engines that do not reach the temperatures specified in the malfunction criteria when the thermostat is functioning

properly. Executive Officer approval shall be granted upon determining that the manufacturer has submitted data that demonstrate that a properly operating system does not reach the specified temperatures, that the monitor is capable of meeting the specified malfunction criteria at engine start temperatures greater than 50 degrees Fahrenheit, and that the possibility for cooling system malfunctions to go undetected and disable other OBD monitors is minimized to the extent technically feasible.

(E) A manufacturer may request Executive Officer approval to be exempted from the requirements of thermostat monitoring. Executive Officer approval shall be granted upon determining that the manufacturer has demonstrated that a malfunctioning thermostat cannot cause a measurable increase in emissions during any reasonable driving condition nor cause any disablement of other monitors.

(1.2.2) ECT Sensor

(A) Circuit Continuity. The OBD system shall detect a malfunction when a lack of circuit continuity or out-of-range values occur.

(B) Time to Reach Closed-Loop/Feedback Enable Temperature.

(i) The OBD system shall detect a malfunction if the ECT sensor does not achieve the highest stabilized minimum temperature which is needed for closed-loop/feedback control of all emission control systems (e.g., fuel system, EGR system) within an Executive Officer-approved time interval after engine start.

(ii) The time interval shall be a function of starting ECT and/or a function of intake air temperature. Executive Officer approval of the time interval shall be granted upon determining that the data and/or engineering evaluation submitted by the manufacturer supports the specified times.

(iii) Manufacturers are exempted from the requirements of section (g)(1.2.2)(B) if the manufacturer does not utilize ECT to enable closed-loop/feedback control of any emission control system.

(C) Stuck in Range Below the Highest Minimum Enable Temperature. To the extent feasible when using all available information, the OBD system shall detect a malfunction if the ECT sensor inappropriately indicates a temperature below the highest minimum enable temperature required by the OBD system to enable other diagnostics (e.g., an OBD system that requires ECT to be greater than 140 degrees Fahrenheit to enable a diagnostic must detect malfunctions that cause the ECT sensor to inappropriately indicate a temperature below 140 degrees Fahrenheit). Manufacturers are exempted from this requirement for temperature regions in which the monitors required under sections (g)(1.2.1) or (g)(1.2.2)(B) will detect ECT sensor malfunctions as defined in section (g)(1.2.2)(C).

(D) Stuck in Range Above the Lowest Maximum Enable Temperature.

(i) To the extent feasible when using all available information, the OBD system shall detect a malfunction if the ECT sensor inappropriately indicates a temperature above the lowest maximum enable temperature required by the OBD system to enable other diagnostics (e.g., an OBD system that requires ECT to be less than 90 degrees Fahrenheit at engine start to enable a diagnostic must detect malfunctions that cause the ECT sensor to inappropriately indicate a temperature above 90 degrees Fahrenheit).

(ii) Manufacturers are exempted from this requirement for temperature regions in which the monitors required under sections (g)(1.2.1), (g)(1.2.2)(B), or (g)(1.2.2)(C) (i.e., ECT sensor or thermostat malfunctions) will detect ECT sensor malfunctions as defined in section (g)(1.2.2)(D) or in which the MIL will be illuminated under the requirements of sections (d)(2.2.1)(E) or (d)(2.2.2)(E) for default mode operation (e.g., overtemperature protection strategies).

(iii) Manufacturers are exempted from the requirements of section (g)(1.2.2)(D) for temperature regions where the temperature gauge indicates a temperature in the red zone (engine overheating zone) for vehicles that have a temperature gauge (not a warning light) on the instrument panel and utilize the same ECT sensor for input to the OBD system and the temperature gauge.

(1.3) Monitoring Conditions:

(1.3.1) Thermostat

(A) Manufacturers shall define the monitoring conditions for malfunctions identified in section (g)(1.2.1)(A) in accordance with section (d)(3.1) except as provided for in section (g)(1.3.1)(E). Additionally, except as provided for in sections (g)(1.3.1)(B) through (E), monitoring for malfunctions identified in section (g)(1.2.1)(A) shall be conducted once per driving cycle on every driving cycle in which the ECT sensor indicates, at engine start, a temperature lower than the temperature established as the malfunction criteria in section (g)(1.2.1)(A).

(B) Manufacturers shall define the monitoring conditions for malfunctions identified in section (g)(1.2.1)(B) in accordance with section (d)(3.1) with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle.

(C) Manufacturers may disable thermostat monitoring at ambient engine temperatures below 20 degrees Fahrenheit.

(D) Manufacturers may request Executive Officer approval to suspend or disable thermostat monitoring if the vehicle is subjected to conditions which could lead to false diagnosis (e.g., vehicle operation at idle for more than 50 percent of the warm-up time, engine block heater operation).– With respect to disablement on driving cycles solely due to warm ECT at engine

start conditions, the manufacturer shall disable the monitor during driving cycles where the ECT at engine start is within 35 degrees Fahrenheit of the thermostat malfunction threshold temperature determined under section (g)(1.2.1)(A) (e.g., if the malfunction threshold temperature is 160 degrees Fahrenheit, the monitor shall be disabled if the ECT at engine start is above 125 degrees Fahrenheit).

(E) Notwithstanding section (g)(1.3.1)(D), manufacturers may request Executive Officer approval to enable thermostat monitoring during a portion of the driving cycles where the ECT at engine start is warmer than 35 degrees Fahrenheit below the thermostat malfunction threshold temperature determined under section (g)(1.2.1)(A) (e.g., if the malfunction threshold temperature is 160 degrees Fahrenheit, the manufacturer may request approval to have the monitor enabled for a portion of the ECT at engine start region between 125 and 160 degrees Fahrenheit). The Executive Officer shall approve the request upon determining that the manufacturer has submitted test data and/or engineering evaluation that demonstrate that the monitor is able to robustly detect thermostat malfunctions (e.g., cannot result in false passes or false indications of malfunctions) on driving cycles where it is enabled.

(F) With respect to defining enable conditions that are encountered during the FTP cycle as required in (d)(3.1.1) for malfunctions identified in section (g)(1.2.1)(A), the FTP cycle shall refer to on-road driving following the FTP cycle in lieu of testing on an engine dynamometer.

(1.3.2) ECT Sensor

(A) Except as provided below in section (g)(1.3.2)(E), monitoring for malfunctions identified in section (g)(1.2.2)(A) (i.e., circuit continuity and out-of-range) shall be conducted continuously.

(B) Manufacturers shall define the monitoring conditions for malfunctions identified in section (g)(1.2.2)(B) in accordance with section (d)(3.1). Additionally, except as provided for in section (g)(1.3.2)(D), monitoring for malfunctions identified in section (g)(1.2.2)(B) shall be conducted once per driving cycle on every driving cycle in which the ECT sensor indicates a temperature lower than the closed-loop enable temperature at engine start (i.e., all engine start temperatures greater than the ECT sensor out-of-range low temperature and less than the closed-loop enable temperature).

(C) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (g)(1.2.2)(C) and (D) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(D) Manufacturers may suspend or delay the time to reach closed-loop enable temperature diagnostic if the vehicle is subjected to conditions which could lead to false diagnosis (e.g., vehicle operation at idle for more than 50 to 75 percent of the warm-up time).

(E) A manufacturer may request Executive Officer approval to disable continuous ECT sensor monitoring when an ECT sensor malfunction cannot be distinguished from other effects. The Executive Officer shall approve the disablement upon determining that the manufacturer has submitted test data and/or engineering evaluation that demonstrate a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false detection.

(1.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(2) Crankcase Ventilation (CV) System Monitoring

(2.1) Requirement: The OBD system shall monitor the CV system on engines so-equipped for system integrity. Engines not subject to crankcase emission control requirements shall be exempt from monitoring of the CV system.

(2.2) Malfunction Criteria:

(2.2.1) For the purposes of section (g)(2), "CV system" is defined as any form of crankcase ventilation system, regardless of whether it utilizes positive pressure or whether it vents to the atmosphere, the intake, or the exhaust. "CV valve" is defined as any form of valve orifice, and/or filter/separator used to restrict, control, or alter the composition (e.g., remove oil vapor or particulate matter) of the crankcase vapor flow. Further, any additional external CV system tubing or hoses used to equalize crankcase pressure or to provide a ventilation path between various areas of the engine (e.g., crankcase and valve cover) are considered part of the CV system "between the crankcase and the CV valve" and subject to the malfunction criteria in section (g)(2.2.2) below.

(2.2.2) Except as provided below, the OBD system shall detect a malfunction of the CV system when a disconnection of the system occurs between either the crankcase and the CV valve, or between the CV valve and the intake ducting.

(2.2.3) If disconnection in the system results in a rapid loss of oil or other overt indication of a CV system malfunction such that the vehicle operator is certain to respond and have the vehicle repaired, the Executive Officer shall exempt the manufacturer from detection of that disconnection.

(2.2.4) The Executive Officer shall exempt a manufacturer from detecting a disconnection between the crankcase and the CV valve upon determining that the disconnection cannot be made without first disconnecting a monitored portion of the system (e.g., the CV system is designed such that the CV valve is fastened directly to the crankcase in a manner which makes it significantly more difficult to remove the valve from the crankcase

rather than disconnect the line between the valve and the intake manifold/ducting (taking aging effects into consideration)) and the line between the valve and the intake ducting is monitored for disconnection. The manufacturer shall file a request and submit data and/or engineering evaluation in support of the exemption.

(2.2.5) Subject to Executive Officer approval, system designs that utilize tubing between the valve and the crankcase shall be exempted from the monitoring requirement for detection of disconnection between the CV valve and the crankcase. The manufacturer shall file a request and submit data and/or engineering evaluation in support of the request. The Executive Officer shall approve the request upon determining that the connections between the valve and the crankcase are: (1) resistant to deterioration or accidental disconnection, (2) significantly more difficult to disconnect than the line between the valve and the intake manifold/ducting, and (3) not subject to disconnection per manufacturer's maintenance, service, and/or repair procedures for non-CV system repair work.

(2.2.6) The Executive Officer shall exempt a manufacturer from detecting a disconnection between the CV valve and the intake manifold upon determining that the disconnection (1) causes the vehicle to stall immediately during idle operation; or (2) is unlikely to occur due to a CV system design that is integral to the induction system (e.g., machined passages rather than tubing or hoses). The manufacturer shall file a request and submit data and/or engineering evaluation in support of the exemption.

(2.2.7) For engines certified on an engine dynamometer having an open CV system (i.e., a system that releases crankcase emissions to the atmosphere without routing them to the intake ducting or to the exhaust upstream of the aftertreatment), the manufacturer shall submit a plan for Executive Officer approval of the monitoring strategy, malfunction criteria, and monitoring conditions prior to OBD certification. Executive Officer approval shall be based on the effectiveness of the monitoring strategy to (i) monitor the performance of the CV system to the extent feasible with respect to the malfunction criteria in section (g)(2.2.1) through (g)(2.2.4) and the monitoring conditions required by the diagnostic, and (ii) monitor the ability of the CV system to control crankcase vapor emitted to the atmosphere relative to the manufacturer's design and performance specifications for a properly functioning system (e.g., if the system is equipped with a filter and/or separator to reduce crankcase emissions to the atmosphere, the OBD system shall monitor the integrity of the filter and/or function of the separator).

(2.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (g)(2.2) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(2.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2). The stored fault code need not specifically identify the CV system (e.g., a fault code for idle speed control or fuel system monitoring can be stored) if the manufacturer demonstrates that additional monitoring hardware would be necessary to make this identification, and provided the manufacturer's diagnostic and repair procedures for the detected malfunction include directions to check the integrity of the CV system.

(3) Comprehensive Component Monitoring

(3.1) Requirement:

(3.1.1) Except as provided in sections (g)(3.1.4), (g)(3.1.5), (g)(3.1.6), and (g)(4), the OBD system shall monitor for malfunction any electronic powertrain component/system not otherwise described in sections (e)(1) through (g)(2) that either provides input to (directly or indirectly) or receives commands from the on-board computer(s), and: (1) can affect emissions during any reasonable in-use driving condition, or (2) is used as part of the diagnostic strategy for any other monitored system or component.

(A) Input Components: Input components required to be monitored may include the crank angle sensor, knock sensor, throttle position sensor, cam position sensor, intake air temperature sensor, boost pressure sensor, manifold pressure sensor, mass air flow sensor, exhaust temperature sensor, exhaust pressure sensor, fuel pressure sensor, fuel composition sensor (e.g. flexible fuel vehicles), and electronic components used to comply with any applicable engine idling requirements of title 13, CCR section 1956.8.

(B) Output Components/Systems: Output components/systems required to be monitored may include the idle speed control system, fuel injectors, glow plug system, variable length intake manifold runner systems, supercharger or turbocharger electronic components, heated fuel preparation systems, and the wait-to-start lamp on diesel applications.

(3.1.2) For purposes of criteria (1) in section (g)(3.1.1) above, the manufacturer shall determine whether an engine input or output component/system can affect emissions. If the Executive Officer reasonably believes that a manufacturer has incorrectly determined that a component/system cannot affect emissions, the Executive Officer shall require the manufacturer to provide emission data showing that the component/system, when malfunctioning and installed in a suitable test vehicle, does not have an emission effect. The Executive Officer may request emission data for any reasonable driving condition.

(3.1.3) Manufacturers shall monitor for malfunction electronic powertrain input or output components/systems associated with an electronic transfer case,

electronic power steering system, transmission (except as provided below in section (g)(3.1.6)), or other components that are driven by the engine and not related to the control of fueling, air handling, or emissions only if the component or system is used as part of the diagnostic strategy for any other monitored system or component.

(3.1.4) Except as specified for hybrid vehicles in section (g)(3.1.5), manufacturers shall monitor for malfunction electronic powertrain input or output components/systems associated with components that only affect emissions by causing additional electrical load to the engine and are not related to the control of fueling, air handling, or emissions only if the component or system is used as part of the diagnostic strategy for any other monitored system or component.

(3.1.5) Except as provided in section (d)(7.6), for hybrid vehicles, manufacturers shall submit a plan to the Executive Officer for approval of the hybrid components determined by the manufacturer to be subject to monitoring in section (g)(3.1.1). In general, the Executive Officer shall approve the plan if it includes monitoring of all components/systems used as part of the diagnostic strategy for any other monitored system or component, monitoring of all energy input devices to the electrical propulsion system, monitoring of battery and charging system performance, monitoring of electric motor performance, and monitoring of regenerative braking performance.

(3.1.6) For OBD systems that receive vehicle speed information from a transmission control unit and use vehicle speed as part of the diagnostic strategy for any other OBD monitored system or component:

(A) The OBD system shall monitor the vehicle speed information to the extent feasible in accordance with the requirements of section (g)(3);

(B) The OBD system shall detect a fault and illuminate the MIL when the OBD system is unable to properly receive the vehicle speed information; and

(C) If the transmission control unit monitors the vehicle speed information and indicates an error of the information to the OBD system (e.g., valid vehicle speed data is no longer available), the OBD system shall handle the error indication as a default mode of operation subject to the MIL illumination requirements under section (d)(2.2).

(3.2) Malfunction Criteria:

(3.2.1) Input Components:

(A) The OBD system shall detect malfunctions of input components caused by a lack of circuit continuity, out-of-range values, and, where feasible, rationality faults. To the extent feasible, the rationality fault diagnostics shall verify that a sensor output is neither inappropriately high nor inappropriately low (i.e., shall be "two-sided" diagnostics).

(B) To the extent feasible, the OBD system shall separately detect and store different fault codes that distinguish rationality faults from lack of circuit continuity and out-of-range faults. For input component lack of circuit continuity and out-of-range faults, the OBD system shall, to the extent feasible, separately detect and store different fault codes for each distinct malfunction (e.g., out-of-range low, out-of-range high, open circuit). The OBD system is not required to store separate fault codes for lack of circuit continuity faults that cannot be distinguished from other out-of-range circuit faults.

(C) For input components that are used to activate alternate strategies that can affect emissions (e.g., AECDs, engine shutdown systems or strategies to meet NOx idling standards required by title 13, CCR section 1956.8), the OBD system shall detect rationality malfunctions that cause the system to erroneously activate or deactivate the alternate strategy. To the extent feasible when using all available information, the rationality fault diagnostics shall detect a malfunction if the input component inappropriately indicates a value that activates or deactivates the alternate strategy. For example, if an alternate strategy requires the intake air temperature to be greater than 120 degrees Fahrenheit to activate, the OBD system shall detect malfunctions that cause the intake air temperature sensor to inappropriately indicate a temperature above 120 degrees Fahrenheit.

(D) For input components that are directly or indirectly used for any emission control strategies that are not covered under sections (e), (f), and (g)(1) (e.g., exhaust temperature sensors used for a control strategy that regulates SCR catalyst inlet temperature within a target window), the OBD system shall detect rationality malfunctions that prevent the component from correctly sensing any condition necessary for the strategy to operate in its intended manner. These malfunctions include faults that inappropriately prevent or delay the activation of the emission control strategy, cause the system to erroneously exit the emission control strategy, or where the control strategy has used up all of the adjustments or authority allowed by the manufacturer and is still unable to achieve the desired condition. The Executive Officer may waive detection of specific malfunctions upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that reliable detection of the malfunction is technically infeasible or would require additional hardware.

(E) For engines that require precise alignment between the camshaft and the crankshaft, the OBD system shall monitor the crankshaft position sensor(s) and camshaft position sensor(s) to verify proper alignment between the camshaft and crankshaft in addition to monitoring the sensors for circuit continuity and rationality malfunctions. Proper alignment monitoring between a camshaft and a crankshaft shall only be required in cases where both are equipped with position sensors. For engines equipped with VVT

systems and a timing belt or chain, the OBD system shall detect a malfunction if the alignment between the camshaft and crankshaft is off by one or more cam/crank sprocket cogs (e.g., the timing belt/chain has slipped by one or more teeth/cogs). If a manufacturer demonstrates that a single tooth/cog misalignment cannot cause a measurable increase in emissions during any reasonable driving condition, the OBD system shall detect a malfunction when the minimum number of teeth/cogs misalignment needed to cause a measurable emission increase has occurred.

(3.2.2) Output Components/Systems:

(A) The OBD system shall detect a malfunction of an output component/system when proper functional response of the component and system to computer commands does not occur. If a functional check is not feasible, the OBD system shall detect malfunctions of output components/systems caused by a lack of circuit continuity or circuit fault (e.g., short to ground or high voltage). For output component lack of circuit continuity faults and circuit faults, the OBD system is not required to store different fault codes for each distinct malfunction (e.g., open circuit, shorted low). Manufacturers are not required to activate an output component/system when it would not normally be active for the purposes of performing functional monitoring of output components/systems as required in section (g)(3).

(B) The idle control system shall be monitored for proper functional response to computer commands.

(i) For gasoline engines using monitoring strategies based on deviation from target idle speed, a malfunction shall be detected when either of the following conditions occur:

a. The idle speed control system cannot achieve the target idle speed within 200 revolutions per minute (rpm) above the target speed or 100 rpm below the target speed. The Executive Officer shall allow larger engine speed tolerances upon determining that a manufacturer has submitted data and/or an engineering evaluation which demonstrate that the tolerances can be exceeded without a malfunction being present.

b. The idle speed control system cannot achieve the target idle speed within the smallest engine speed tolerance range required by the OBD system to enable any other monitors.

(ii) For diesel engines, a malfunction shall be detected when any of the following conditions occur:

a. The idle control system cannot achieve or maintain the idle speed within +/-50 percent of the manufacturer-specified target or desired engine speed.

b. The idle control system cannot achieve the target or desired idle speed within the smallest engine speed tolerance range required by the OBD system to enable any other monitors.

c. For 2013 and subsequent model year engines, the idle control system cannot achieve the fueling quantity within the smallest fueling quantity tolerance range required by the OBD system to enable any other monitors.

d. For 2013 and subsequent model year engines, the idle control system cannot achieve the target idle speed with a fuel injection quantity within +/-50 percent of the fuel quantity necessary to achieve the target idle speed for a properly functioning engine and the known operating conditions.

(C) Glow plugs/intake air heater systems shall be monitored for proper functional response to computer commands and for circuit continuity faults. The glow plug/intake air heater circuit(s) shall be monitored for proper current and voltage drop. The Executive Officer shall approve other monitoring strategies based on manufacturer's data and/or engineering analysis demonstrating equally reliable and timely detection of malfunctions. Except as provided below, the OBD system shall detect a malfunction when a single glow plug no longer operates within the manufacturer's specified limits for normal operation. If a manufacturer demonstrates that a single glow plug failure cannot cause a measurable increase in emissions during any reasonable driving condition, the OBD system shall detect a malfunction for the minimum number of glow plugs needed to cause an emission increase. Further, to the extent feasible on existing engine designs (without adding additional hardware for this purpose) and on all 2013 and subsequent model year engines, the stored fault code shall identify the specific malfunctioning glow plug(s).

(D) The wait-to-start lamp circuit shall be monitored for malfunctions that cause the lamp to fail to illuminate when commanded on (e.g., burned out bulb).

(E) For output components/systems that are directly or indirectly used for any emission control strategies that are not covered under sections (e), (f), and (g)(1) (e.g., an intake throttle used for a control strategy that adjusts intake throttle position to regulate SCR catalyst inlet temperature within a target window), the OBD system shall detect functional malfunctions that prevent the component/system from achieving the desired functional response necessary for the strategy to operate in its intended manner. These malfunctions include faults that inappropriately prevent or delay the activation of the emission control strategy, cause the system to erroneously exit the emission control strategy, or where the control strategy has used up all of the adjustments or authority allowed by the manufacturer and is still unable to achieve the desired condition. The Executive Officer may waive detection of specific malfunctions upon determining that the

manufacturer has submitted data and/or an engineering evaluation that demonstrate that reliable detection of the malfunction is technically infeasible or would require additional hardware.

(F) For 2015 and subsequent model year engines that utilize fuel control system components (e.g., injectors, fuel pump) that have tolerance compensation features implemented in hardware or software during production or repair procedures (e.g., individually coded injectors for flow characteristics that are programmed into an electronic control unit to compensate for injector to injector tolerances, fuel pumps that use in-line resistors to correct for differences in fuel pump volume output), the components shall be monitored to ensure the proper compensation is being used.

(i) Except as provided in section (g)(3.2.2)(F)(ii) below, the system shall detect a fault if the compensation being used by the control system does not match the compensation designated for the installed component (e.g., the flow characteristic coding designated on a specific injector does not match the compensation being used by the fuel control system for that injector). If a manufacturer demonstrates that a single component (e.g., injector) using the wrong compensation cannot cause a measurable increase in emissions during any reasonable driving condition, the manufacturer shall detect a malfunction for the minimum number of components using the wrong compensation needed to cause an emission increase. Further, the stored fault code shall identify the specific component that does not match the compensation.

(ii) Monitoring of the fuel control system components under section (g)(3.2.2)(F)(i) is not required if the manufacturer demonstrates that both of the following criteria are satisfied: (1) no fault of the components' tolerance compensation features (e.g., wrong compensation being used) could cause emissions to increase by 15 percent or more of the applicable standard as measured from an applicable emission test cycle; and (2) no fault of the components' tolerance compensation features can cause emissions to exceed the applicable standard as measured from an applicable emission test cycle. For purposes of determining if the emission criteria above are met, the manufacturers shall request Executive Officer approval of the test plan for which the emission impact will be determined. The test plan shall include the combination of failed components and the degree of mismatch (e.g., wrong compensation) used as well as the test procedure and emission test cycles used to demonstrate the emission impact, including the necessary preconditioning cycles used by the system to correct or adapt for any mismatch and mitigate the emission impact. Executive Officer approval shall be granted upon determining that the manufacturer has submitted data and/or engineering analysis that demonstrate that the conditions necessary for the system to correct or adapt will readily occur in a timely manner during in-use operation

and that the test conditions represent worst case emissions from typical in-use service actions when considering the distribution and variance of the compensation values and parts (e.g., replacement of one or more plus-one-sigma injectors with minus-one-sigma injectors without updating of the compensation value).

(3.3) Monitoring Conditions:

(3.3.1) Input Components:

(A) Except as provided in section (g)(3.3.1)(C), input components shall be monitored continuously for proper range of values and circuit continuity.

(B) For rationality monitoring (where applicable) manufacturers shall define the monitoring conditions for detecting malfunctions in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that rationality monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2).

(C) A manufacturer may request Executive Officer approval to disable continuous input component proper range of values or circuit continuity monitoring when a malfunction cannot be distinguished from other effects. The Executive Officer shall approve the disablement upon determining that the manufacturer has submitted test data and/or documentation that demonstrate a properly functioning input component cannot be distinguished from a malfunctioning input component and that the disablement interval is limited only to that necessary for avoiding false detection.

(3.3.2) Output Components/Systems:

(A) Except as provided in section (g)(3.3.2)(D), monitoring for circuit continuity and circuit faults shall be conducted continuously.

(B) Except as provided in section (g)(3.3.2)(C), for functional monitoring, manufacturers shall define the monitoring conditions for detecting malfunctions in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(C) For the idle control system, manufacturers shall define the monitoring conditions for functional monitoring in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that functional monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2).

(D) A manufacturer may request Executive Officer approval to disable continuous output component circuit continuity or circuit fault monitoring when a malfunction cannot be distinguished from other effects. The Executive Officer shall approve the disablement upon determining that the

manufacturer has submitted test data and/or documentation that demonstrate a properly functioning output component cannot be distinguished from a malfunctioning output component and that the disablement interval is limited only to that necessary for avoiding false detection.

(3.4) MIL Illumination and Fault Code Storage:

(3.4.1) Except as provided in sections (g)(3.4.2) and (3.4.4) below, general requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(3.4.2) Exceptions to general requirements for MIL illumination. MIL illumination is not required in conjunction with storing a confirmed or MIL-on fault code for any comprehensive component if:

(A) the component or system, when malfunctioning, could not cause engine emissions to increase by 15 percent or more of the FTP standard during any reasonable driving condition; and

(B) the component or system is not used as part of the diagnostic strategy for any other monitored system or component.

(3.4.3) For purposes of determining the emission increase in section (g)(3.4.2)(A), the manufacturer shall request Executive Officer approval of the test cycle/vehicle operating conditions for which the emission increase will be determined. Executive Officer approval shall be granted upon determining that the manufacturer has submitted data and/or engineering evaluation that demonstrate that the testing conditions represent in-use driving conditions where emissions are likely to be most affected by the malfunctioning component. For purposes of determining whether the specified percentages in section (g)(3.4.2)(A) are exceeded, if the approved testing conditions are comprised of an emission test cycle with an exhaust emission standard, the measured increase shall be compared to a percentage of the exhaust emission standard (e.g., if the increase is equal to or more than 15 percent of the exhaust emission standard for that test cycle). If the approved testing conditions are comprised of a test cycle or vehicle operating condition that does not have an exhaust emission standard, the measured increase shall be calculated as a percentage of the baseline test (e.g., if the increase from a back-to-back test sequence between normal and malfunctioning condition is equal to or more than 15 percent of the baseline test results from the normal condition).

(3.4.4) For malfunctions required to be detected by section (g)(3.2.2)(B)(ii)d. (idle control fuel injection quantity faults), the stored fault code is not required to specifically identify the idle control system (e.g., a fault code for cylinder fuel injection quantity imbalance or combustion quality monitoring can be stored).

(4) Other Emission Control System Monitoring

(4.1) Requirement: For other emission control systems that are: (1) not identified or addressed in sections (e)(1) through (g)(3) (e.g., hydrocarbon traps, homogeneous charge compression ignition (HCCI) control systems), or (2) identified or addressed in section (g)(3) but not corrected or compensated for by an adaptive control system (e.g., swirl control valves), manufacturers shall submit a plan for Executive Officer approval of the monitoring strategy, malfunction criteria, and monitoring conditions prior to introduction on a production engine. Executive Officer approval shall be based on the effectiveness of the monitoring strategy, the malfunction criteria utilized, the monitoring conditions required by the diagnostic, and, if applicable, the determination that the requirements of section (g)(4.2) and (g)(4.3) below are satisfied.

(4.2) For engines that utilize emission control systems that alter intake air flow or cylinder charge characteristics by actuating valve(s), flap(s), etc. in the intake air delivery system (e.g., swirl control valve systems), the manufacturers, in addition to meeting the requirements of section (g)(4.1) above, may elect to have the OBD system monitor the shaft to which all valves in one intake bank are physically attached in lieu of monitoring the intake air flow, cylinder charge, or individual valve(s)/flap(s) for proper functional response. For non-metal shafts or segmented shafts, the monitor shall verify all shaft segments for proper functional response (e.g., by verifying the segment or portion of the shaft furthest from the actuator properly functions). For systems that have more than one shaft to operate valves in multiple intake banks, manufacturers are not required to add more than one set of detection hardware (e.g., sensor, switch) per intake bank to meet this requirement.

(4.3) For emission control strategies that are not covered under sections (e), (f), and (g)(1) (e.g., a control strategy that regulates SCR catalyst inlet temperatures within a target window), Executive Officer approval shall be based on the effectiveness of the plan in detecting malfunctions that prevent the strategy from operating in its intended manner. These malfunctions include faults that inappropriately prevent or delay the activation of the emission control strategy, faults that cause the system to erroneously exit the emission control strategy, and faults where the control strategy has used up all of the adjustments or authority allowed by the manufacturer and is still unable to achieve the desired condition. The Executive Officer may waive detection of specific malfunctions upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that reliable detection of the malfunction is technically infeasible or would require additional hardware.

(5) Exceptions to Monitoring Requirements

(5.1) Upon request of a manufacturer or upon the best engineering judgment of ARB, the Executive Officer may revise the emission threshold for any monitor

in sections (e) through (g) if the most reliable monitoring method developed requires a higher threshold to prevent false indications of a malfunction. Additionally, except as specified in section (e)(8.2.1)(C), for 2010 through 2015 model year engines, the Executive Officer may revise the PM filter malfunction criteria of section (e)(8.2.1) to exclude detection of specific failure modes (e.g., partially melted substrates) if the most reliable monitoring method developed requires the exclusion of specific failure modes to prevent false indications of a malfunction.

(5.2) For 2010 through 2012 model year diesel engines, in determining the malfunction criteria for diesel engine monitors in sections (e)(1), (3), (4), (5), (8.2.2), (9.2.1)(A), and (e)(10), the manufacturer shall use a threshold of 2.5 times any of the applicable NMHC, CO, or NOx standards in lieu of 2.0 times any of the applicable standards.

(5.3) Manufacturers may request Executive Officer approval to disable an OBD system monitor at ambient temperatures below 20 degrees Fahrenheit (low ambient temperature conditions may be determined based on intake air or engine coolant temperature at engine start) or at elevations above 8000 feet above sea level. The Executive Officer shall approve the request upon determining that the manufacturer has provided data and/or an engineering evaluation that demonstrate that monitoring during the conditions would be unreliable. A manufacturer may further request, and the Executive Officer shall approve, that an OBD system monitor be disabled at other ambient temperatures upon determining that the manufacturer has demonstrated with data and/or an engineering evaluation that misdiagnosis would occur at the ambient temperatures because of its effect on the component itself (e.g., component freezing).

(5.4) Manufacturers may request Executive Officer approval to disable monitoring systems that can be affected by low fuel level or running out of fuel (e.g., misfire detection) when the fuel level is 15 percent or less of the nominal capacity of the fuel tank. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that monitoring at the fuel levels would be unreliable and the OBD system is able to detect a malfunction if the component(s) used to determine fuel level erroneously indicates a fuel level that causes the disablement.

(5.5) Manufacturers may disable monitoring systems that can be affected by vehicle battery or system voltage levels.

(5.5.1) For monitoring systems affected by low vehicle battery or system voltages, manufacturers may disable monitoring systems when the battery or system voltage is below 11.0 Volts. Manufacturers may request Executive Officer approval to utilize a voltage threshold higher than 11.0 Volts to disable system monitoring. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that monitoring at the voltages

would be unreliable and that either operation of a vehicle below the disablement criteria for extended periods of time is unlikely or the OBD system monitors the battery or system voltage and will detect a malfunction at the voltage used to disable other monitors.

(5.5.2) For monitoring systems affected by high vehicle battery or system voltages, manufacturers may request Executive Officer approval to disable monitoring systems when the battery or system voltage exceeds a manufacturer-defined voltage. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that monitoring above the manufacturer-defined voltage would be unreliable and that either the electrical charging system/alternator warning light is illuminated (or voltage gauge is in the "red zone") or the OBD system monitors the battery or system voltage and will detect a malfunction at the voltage used to disable other monitors.

(5.6) A manufacturer may request Executive Officer approval to disable monitors that can be affected by PTO activation on engines or vehicles designed to accommodate the installation of PTO units (as defined in section (c)).

(5.6.1) Except as allowed in section (g)(5.6.2) below, a manufacturer may request Executive Officer approval to disable an affected monitor provided disablement occurs only while the PTO unit is active and the OBD readiness status (specified under section (h)(4.1)) and PTO activation time are appropriately tracked and erased as described in this section. The Executive Officer shall approve the request for disablement based on the manufacturer's demonstration that the affected monitor cannot robustly detect malfunctions (e.g., cannot avoid false passes or false indications of malfunctions) while the PTO unit is active. The OBD system shall track the cumulative engine runtime with PTO active and clear OBD readiness status (i.e., set all monitors to indicate "not complete") no later than the start of the next ignition cycle if 750 minutes of cumulative engine runtime with PTO active has occurred since the last time the affected monitor has determined the component or system monitored by the affected monitor is or is not malfunctioning (i.e., has completed). The PTO timer shall pause whenever PTO changes from active to not active and resume counting when PTO is re-activated. The timer shall be reset to zero after the affected monitor has completed and no later than the start of the next ignition cycle. Once the PTO timer has reached 750 minutes and the OBD readiness status has been cleared, the PTO timer may not cause the OBD system to clear the readiness status again until after the PTO timer has reset to zero (after the monitor has completed) and again reached 750 minutes.

(5.6.2) For 2010 through 2012 model year engines, in lieu of requesting Executive Officer approval for disabling an affected monitor according to section (g)(5.6.1) above, a manufacturer may disable affected monitors, provided disablement occurs only while the PTO unit is active, and the OBD

readiness status is cleared by the on-board computer (i.e., all monitors set to indicate "not complete") while the PTO unit is activated. If the disablement occurs, the readiness status may be restored to its state prior to PTO activation when the disablement ends.

(5.7) The OBD system is not required to monitor an electronic powertrain component/system if the following criteria are met when the ambient temperature is above 20 degrees Fahrenheit: (1) a malfunction of the component does not affect emissions during any reasonable driving condition, (2) a malfunction of the component does not affect the diagnostic strategy for any other monitored component or system, and (3) the ambient temperature is determined based on a temperature sensor monitored by the OBD system (e.g., IAT sensor). The manufacturer shall determine whether a component/system meets these criteria. If the Executive Officer reasonably believes that a manufacturer has incorrectly determined that a component/system meets these criteria, the Executive Officer shall require the manufacturer to provide emission and/or other diagnostic data showing that the component/system, when malfunctioning and installed in a suitable test vehicle, does not have an effect on emissions or other diagnostic strategies. The Executive Officer may request emission data for any reasonable driving condition at ambient temperatures above 20 degrees Fahrenheit.

(5.8) Whenever the requirements in section (e), (f), or (g) of this regulation require a manufacturer to meet a specific phase-in schedule:

(5.8.1) Except as provided for in section (g)(5.8.3) below for the diesel NOx converting catalyst and NOx and PM sensor phase-ins and in section (e)(8.2.1) for the PM filter monitor phase-in, manufacturers may use an alternate phase-in schedule in lieu of the phase-in schedule set forth in sections (e), (f), or (g) if the alternate phase-in schedule provides for equivalent compliance volume as defined in section (c).

(5.8.2) Small volume manufacturers may use an alternate phase-in schedule in accordance with section (g)(5.8.1) in lieu of the required phase-in schedule or may use a different schedule as follows:

(A) For the diesel misfire monitor phase-in schedule in section (e)(2.2.2), the manufacturer may meet the requirement on all engines by the 2018 model year in lieu of meeting the specific phase-in requirements for the 2016 and 2017 model years.

(B) For the diesel misfire monitor phase-in schedule in section (e)(2.3.3), the manufacturer may meet the monitoring conditions requirements of section (e)(2.3.3)(A)(i) on all engines subject to (e)(2.2.2) through the 2020 model year and the monitoring conditions requirements of section (e)(2.3.3)(A)(ii) on all 2021 and subsequent model year engines in lieu of the specific phase-in requirements in section (e)(2.3.3)(A) for the 2019 and 2020 model years.

(C) For the diesel NOx converting catalyst monitor phase-in schedules in section (e)(6), the manufacturer may use the malfunction criteria in sections (e)(6.2.1)(B) and (e)(6.2.2)(A)(ii) for all 2014 and 2015 model year engines in lieu of the malfunction criteria and required phase-in schedule in sections (e)(6.2.1)(C) and (e)(6.2.2)(A)(iii).

(D) For the diesel PM filter monitor phase-in schedule in section (e)(8), the manufacturer may use the malfunction criteria in section (e)(8.2.1)(B) for all 2014 and 2015 model year engines in lieu of the malfunction criteria and required phase-in schedule in section (e)(8.2.1)(C).

(E) For the diesel NOx sensor phase-in schedules in section (e)(9), the manufacturer may use the malfunction criteria in section (e)(9.2.2)(A)(ii) for all 2014 and 2015 model year engines in lieu of the malfunction criteria and required phase-in schedule in section (e)(9.2.2)(A)(iii).

(5.8.3) In lieu of meeting the diesel NOx converting catalyst and NOx and PM sensor phase-ins set forth in sections (e)(6.2.1), (e)(6.2.2), and (e)(9.2.2), a manufacturer may request Executive Officer approval to use a manufacturer-defined phase-in for each requirement. The Executive Officer shall approve the manufacturer-defined phase-in if it meets the following criteria:

(A) For the requirements in sections (e)(6.2.1)(C), (e)(6.2.2)(A)(iii), and (e)(9.2.2)(A)(iii) (i.e., requiring a NOx threshold of +0.3 g/bhp-hr):

(i) The phase-in shall provide for a compliance volume of engines certified to the +0.3 g/bhp-hr NOx threshold that is equivalent to the volume of the required phase-in set forth in each of the above-referenced sections (i.e., the phase-in of 20 percent of 2014 model year diesel engines and 50 percent of 2015 model year diesel engines). The compliance volume shall be calculated in accordance with the calculation methodology in the definition of "alternate phase-in" in section (c) (i.e., (20*2 years) + (50*1 year) = 90 for the required phase-in). The compliance volume shall be considered equivalent if the calculated total is equal to or greater than 90.

(ii) The calculated compliance volume for the manufacturer-defined phase-in may not include engines meeting the +0.3 g/bhp-hr NOx threshold requirement earlier than the 2013 model year.

(iii) For the 2013 through 2017 model years, engines meeting the requirements in sections (e)(6.2.1)(D), (e)(6.2.2)(A)(iv), and (e)(9.2.2)(A)(iv) (i.e., requiring a NOx threshold of +0.2 g/bhp-hr) shall also be considered as meeting the +0.3 g/bhp-hr NOx threshold requirement and included in the calculated compliance volume and shall not be subtracted from the calculated compliance volume.

(iv) For the 2016 model year, if the proposed phase-in results in a combined percentage of engines meeting the +0.3 g/bhp-hr and the

+0.2 g/bhp-hr thresholds being less than 50 percent of all diesel engines, the manufacturer shall subtract those engines that do not meet the above thresholds in both the 2015 and 2016 model years from the required percentage of 50 percent when calculating the compliance volume according to the calculation methodology in the definition of "alternate phase-in" section (c).

(v) All engines shall meet either the +0.3 g/bhp-hr NOx threshold or the +0.2 g/bhp-hr NOx threshold no later than the 2017 model year.

(B) For the requirements in sections (e)(6.2.1)(D), (e)(6.2.2)(A)(iv), and (e)(9.2.2)(A)(iv) (i.e., requiring a NOx threshold of +0.2 g/bhp-hr):

(i) The phase-in shall provide for a compliance volume of engines certified to the +0.2 g/bhp-hr NOx threshold that is equivalent to the volume of the required phase-in set forth in each of the above-referenced sections (i.e., 100 percent of 2016 model year diesel engines). The compliance volume shall be calculated in accordance with the calculation methodology in the definition of "alternate phase-in" in section (c) (i.e., (100*1 year) = 100 for the required phase-in). The compliance volume shall be considered equivalent if the calculated total is equal to or greater than 100.

(ii) The calculated compliance volume for the manufacturer-defined phase-in shall not include engines meeting the +0.2 g/bhp-hr NOx threshold requirement earlier than the 2015 model year.

(iii) For the 2016 model year only, engines meeting the NOx threshold of +0.3 g/bhp-hr and carried over from the 2014 or 2015 model year per sections (e)(6.2.1)(E), (e)(6.2.2)(A)(v), and (e)(9.2.2)(A)(v) shall also be considered as meeting the +0.2 g/bhp-hr NOx threshold requirement and included in the calculated compliance volume and shall not be subtracted from the calculated compliance volume.

(iv) If the phase-in includes engines that do not meet the +0.2 g/bhp-hr NOx threshold in the 2017 model year, the manufacturer shall subtract those engines that do not meet the threshold in the 2016 and 2017 model years (except as allowed for the 2016 model year in section (g)(5.8.3)(B)(iii) above) from the required percentage of 100 percent when calculating the compliance volume according to the calculation methodology in the definition of "alternate phase-in" section (c).

(v) All engines shall meet the +0.2 g/bhp-hr NOx threshold no later than the 2018 model year.

(5.9) Whenever the requirements in sections (e) through (g) of this regulation require monitoring "to the extent feasible", the manufacturer shall submit its proposed monitor(s) for Executive Officer approval. The Executive Officer shall approve the proposal upon determining that the proposed monitor(s) meets the criteria of "to the extent feasible" by considering the best available monitoring technology to the extent that it is known or should have been

known to the manufacturer and given the limitations of the manufacturer's existing hardware, the extent and degree to which the monitoring requirements are met in full, the limitations of monitoring necessary to prevent significant errors of commission and omission, and the extent to which the manufacturer has considered and pursued alternative monitoring concepts to meet the requirements in full. The manufacturer's consideration and pursuit of alternative monitoring concepts shall include evaluation of other modifications to the proposed monitor(s), the monitored components themselves, and other monitors that use the monitored components (e.g., altering other monitors to lessen the sensitivity and reliance on the component or characteristic of the component subject to the proposed monitor(s)).

(h) *Standardization Requirements.*

(1) Reference Documents:

The following Society of Automotive Engineers (SAE) and International Organization of Standards (ISO) documents are incorporated by reference into this regulation:

(1.1) SAE J1930 "Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms – Equivalent to ISO/TR 15031-2", October 2008 (SAE J1930).

(1.1.1) SAE J1930-DA "Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms Web Tool Spreadsheet", March 2012.

(1.2) SAE J1962 "Diagnostic Connector – Equivalent to ISO/DIS 15031-3: December 14, 2001", April 2002 (SAE J1962).

(1.3) SAE J1978 "OBD II Scan Tool – Equivalent to ISO/DIS 15031-4: December 14, 2001", April 2002 (SAE J1978).

(1.4) SAE J1979 "E/E Diagnostic Test Modes", February 2012 (SAE J1979).

(1.4.1) SAE J1979-DA "Digital Annex of E/E Diagnostic Test Modes", October 2011.

(1.5) SAE J2012 "Diagnostic Trouble Code Definitions", December 2007 (SAE J2012).

(1.5.1) SAE J2012-DA "Digital Annex of Diagnostic Trouble Code Definitions and Failure Type Byte Definitions", July 2010.

(1.6) ISO 15765-4"Road Vehicles-Diagnostics Communication over Controller Area Network (CAN) - Part 4: Requirements for emission-related systems", February 2011 (ISO 15765-4).

(1.7) SAE J1939 consisting of:

(1.7.1) J1939 Recommended Practice for a Serial Control and Communications

Vehicle Network, April 2011;

(1.7.2) J1939/1 On-Highway Equipment Control and Communication Network May 2011;

(1.7.3) J1939/11 Physical Layer, 250K bits/s, Twisted Shielded Pair, September 2006;

(1.7.4) J1939/13 Off-Board Diagnostic Connector, October 2011;

(1.7.5) J1939/15 Reduced Physical Layer, 250K bits/sec, UN-Shielded Twisted Pair (UTP), August 2008;

(1.7.6) J1939/21 Data Link Layer, December 2010;

(1.7.7) J1939/31 Network Layer, May 2010;

(1.7.8) J1939/71 Vehicle Application Layer (Through May 2010), March 2011;

(1.7.9) J1939/73 Application Layer—Diagnostics, February 2010;

(1.7.10) J1939/81 Network Management, June 2011; and

(1.7.11) J1939/84 OBD Communications Compliance Test Cases For Heavy Duty Components and Vehicles, December 2010.

(1.8) SAE J2403 "Medium/Heavy-Duty E/E Systems Diagnosis Nomenclature," February 2011 (SAE J2403).

(1.9) SAE J1699-3 "Vehicle OBD II Compliance Test Cases", December 2009 (SAE J1699-3).

(1.10) SAE J2534-1 "Recommended Practice for Pass-Thru Vehicle Programming", December 2004 (SAE J2534-1).

(2) Diagnostic Connector:

A standard data link connector conforming to SAE J1962 or SAE J1939-13 specifications (except as specified in section (h)(2.3)) shall be incorporated in each vehicle.

(2.1) For the 2010 through 2012 model year engines:

(2.1.1) The connector shall be located in the driver's side foot-well region of the vehicle interior in the area bound by the driver's side of the vehicle and the driver's side edge of the center console (or the vehicle centerline if the vehicle does not have a center console) and at a location no higher than the bottom of the steering wheel when in the lowest adjustable position. The connector may not be located on or in the center console (i.e., neither on the horizontal faces near the floor-mounted gear selector, parking brake lever, or cup-holders nor on the vertical faces near the car stereo, climate system, or navigation system controls).

(2.1.2) The location of the connector shall be capable of being easily identified and accessed (e.g., to connect an off-board tool). For vehicles equipped with a driver's side door, the connector shall be capable of being easily identified and accessed by a technician standing (or "crouched") on the ground outside the driver's side of the vehicle with the driver's side door open.

(2.2) For 2013 and subsequent model year engines:

(2.2.1) The connector shall be located in the driver's side foot-well region of the vehicle interior in the area bound by the driver's side of the vehicle and the foot pedal closest to the driver's side of the vehicle (left most pedal in a left hand drive vehicle) excluding a foot-activated emergency brake if equipped (e.g., typically the brake pedal for an automatic transmission equipped vehicle or the clutch pedal for a manual transmission equipped vehicle) and at a location no higher than the bottom of the steering wheel when in the lowest adjustable position.

(2.2.2) The connector shall be mounted in an uncovered location and may not be covered with or located behind any form of panel, access door, or storage device (e.g., fuse panel cover, hinged door, ashtray, coinbox) that requires opening or removal to access the connector. The connector may be equipped with a dust cap in the shape and size of the diagnostic connector for environmental protection purposes but the dust cap must be removable by hand without the use of any tools and be labeled "OBD" to aid technicians in identifying the connector.

(2.2.3) The connector shall be mounted in a manner that allows vehicle operation and driving (e.g., does not interfere with use of driver controls such as the clutch, brake, and accelerator pedal) while a scan tool is connected to the vehicle.

(2.3) The location of the connector shall be capable of being easily identified and accessed (e.g., to connect an off-board tool). For vehicles equipped with a driver's side door, the connector shall be capable of being easily identified and accessed by a technician standing (or "crouched") on the ground outside the driver's side of the vehicle with the driver's side door open.

(2.4) If the ISO 15765-4 protocol (see section (h)(3)) is used for the required OBD standardized functions, the connector shall meet the "Type A" specifications of SAE J1962. Any pins in the connector that provide electrical power shall be properly fused to protect the integrity and usefulness of the connector for diagnostic purposes and may not exceed 20.0 Volts DC regardless of the nominal vehicle system or battery voltage (e.g., 12V, 24V, 42V).

10/2/25
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(2.5) If the SAE J1939 protocol (see section (h)(3)) is used for the required OBD standardized functions, the connector shall meet the "Type 1" or "Type 2" specifications of SAE J1939-13 if the 250 kbps baud rate of J1939 is used and the "Type 2" specifications of J1939-13 if the 500 kbps baud rate of J1939 is used. Any pins in the connector that provide electrical power shall be properly fused to protect the integrity and usefulness of the connector for diagnostic purposes.

(2.6) Manufacturers may equip vehicles with additional diagnostic connectors for manufacturer-specific purposes (i.e., purposes other than the required OBD functions). However, if the additional connector conforms to the "Type A" specifications of SAE J1962 or the specifications of SAE J1939-13:

(2.6.1) For 2010 through 2015 model year engines, if the additional connector is located in the vehicle interior near the required connector of section (h)(2), the connector(s) must be clearly labeled to identify which connector is used to access the standardized OBD information required in section (h).

(2.6.2) For 2016 and subsequent model year engines, the additional connector may not be in the location specified in section (h)(2.2.1).

(3) Communications to a Scan Tool:

All OBD control modules (e.g., engine, auxiliary emission control module) on a single vehicle shall use the same protocol for communication of required emission-related messages from on-board to off-board network communications to a scan tool meeting SAE J1978 specifications or designed to communicate with an SAE J1939 network. Engine manufacturers shall not alter normal operation of the engine emission control system due to the presence of off-board test equipment accessing information required by section (h). The OBD system shall use one of the following standardized protocols:

(3.1) ISO 15765-4. All required emission-related messages using this protocol shall use a 500 kbps baud rate.

(3.2) SAE J1939. This protocol may only be used on vehicles with diesel engines (including diesel engines converted to alternate-fueled engines). For 2010 through 2015 model year engines, all required emission-related messages using this protocol on an individual vehicle shall use either the 250 kbps or the 500 kbps baud rate. The 250 kbps baud rate may not be used on 2016 or subsequent model year engines.

(4) Required Emission Related Functions:

The following standardized functions shall be implemented in accordance with the specifications in SAE J1979 or SAE J1939 to allow for access to the required information by a scan tool meeting SAE J1978 specifications or designed to

communicate with an SAE J1939 network:

(4.1) Readiness Status: In accordance with SAE J1979/J1939-73 specifications, the OBD system shall indicate "complete" or "not complete" since the fault memory was last cleared for each of the installed monitored components and systems identified in sections (e)(1) through (f)(9), and (g)(3) except (e)(11) and (f)(4).

(4.1.1) The readiness status for the following component/system readiness bits shall always indicate "complete":

(A) Diesel misfire (section (e)(2)) for engines without a separate monitor designed to detect misfires identified in section (e)(2.2.1) and subject to the monitoring conditions of sections (e)(2.3.1) and (e)(2.3.2);

(B) Gasoline misfire (section (f)(2)); and

(C) Diesel and gasoline comprehensive component (section (g)(3)).

(4.1.2) For 2010 through 2015 model year engines, for components and systems not listed in section (h)(4.1.1) above, the readiness status shall immediately indicate "complete" upon the respective monitor(s) (except those monitors specified under section (h)(4.1.7) below) determining that the component or system is not malfunctioning. The readiness status for a component or system shall also indicate "complete" if after the requisite number of decisions necessary for determining MIL status has been fully executed, the monitor indicates a malfunction for the component or system.

(4.1.3) For 2016 and subsequent model year engines, for components and systems not listed in section (h)(4.1.1) above, the readiness status for each component/system readiness bit listed below shall immediately indicate "complete" if any of the following conditions occur: (1) all the respective supported monitors listed below for each component/system have fully executed and determined that the component or system is not malfunctioning, or (2) at least one of the monitors listed below for each component/system has determined that the component or system is malfunctioning after the requisite number of decisions necessary for determining the MIL status have been fully executed, regardless of whether or not the other monitors listed have been fully executed:

(A) Diesel Fuel System: sections (e)(1.2.1), (e)(1.2.2), and (e)(1.2.3)

(B) Diesel Misfire: section (e)(2.2.1) for engines with a separate monitor designed to detect misfires identified in section (e)(2.2.1) and subject to the monitoring conditions of sections (e)(2.3.1) and (e)(2.3.2)

(C) Diesel EGR/VVT: sections (e)(3.2.1), (e)(3.2.2), (e)(3.2.3), (e)(3.2.5), (e)(3.2.6), and (e)(10.2)

(D) Diesel Boost Pressure Control System: sections (e)(4.2.1), (e)(4.2.2), (e)(4.2.3), and (e)(4.2.4)

(E) Diesel NMHC Converting Catalyst: sections (e)(5.2.2) and (e)(5.2.3)(A)

(F) Diesel NOx Converting Catalyst: section (e)(6.2.1)

(G) Diesel NOx Aftertreatment: sections (e)(7.2.1) and (e)(7.2.2)

(H) Diesel PM Filter: sections (e)(8.2.1), (e)(8.2.2), (e)(8.2.5), and (e)(8.2.6)

(I) Diesel Exhaust Gas Sensor: sections (e)(9.2.1)(A)(i), (e)(9.2.1)(A)(iv), (e)(9.2.1)(B)(i), (e)(9.2.1)(B)(iv), (e)(9.2.2)(A), (e)(9.2.2)(D), and (e)(9.2.3)(A)

(J) Gasoline Fuel System: section (f)(1.2.1)(C)

(K) Gasoline EGR/VVT: sections (f)(3.2.1), (f)(3.2.2), (f)(9.2.1), (f)(9.2.2), and (f)(9.2.3)

(L) Gasoline Secondary Air System: sections (f)(5.2.1), (f)(5.2.2), (f)(5.2.3), and (f)(5.2.4)

(M) Gasoline Catalyst: section (f)(6.2.1)

(N) Gasoline Evaporative System: sections (f)(7.2.2)(A) and (f)(7.2.2)(B)

(O) Gasoline Oxygen Sensor: sections (f)(8.2.1)(A), (f)(8.2.1)(D), (f)(8.2.2)(A), and (f)(8.2.2)(C)

(4.1.4) For 2016 and subsequent model year engines, for monitors that detect faults of more than one major emission-related component (e.g., a single monitor that is used to detect both oxygen sensor faults that are tied to the oxygen sensor readiness bit and air-fuel ratio cylinder imbalance faults that are tied to the fuel system readiness bit), the manufacturer shall include the monitor only in the readiness status for the component/system that the monitor is primarily calibrated, intended, or expected in-use to detect faults of.

(4.1.5) Except for the readiness bits listed under section (h)(4.1.1) above, the readiness status for each of the monitored components or systems shall indicate "not complete" whenever fault memory has been cleared or erased by a means other than that allowed in section (d)(2). Normal vehicle shut down (i.e., key off, engine off) may not cause the readiness status to indicate "not complete".

(4.1.6) If the manufacturer elects to additionally indicate readiness status through the MIL in the key on, engine off position as provided for in section (d)(2.1.3), the readiness status shall be indicated in the following manner: If the readiness status for all monitored components or systems is "complete", the MIL shall continuously illuminate in the key on, engine off position for at least 15 seconds as required by section (d)(2.1.2). If the readiness status for one or more of the monitored components or systems is "not complete", after 15-20 seconds of operation in the key on, engine off position with the MIL illuminated continuously as required by section (d)(2.1.2), the MIL shall blink once per second for 5-10 seconds. The data stream value for MIL status (section (h)(4.2)) shall indicate "commanded

off" during this sequence unless the MIL has also been "commanded on" for a detected fault.

(4.1.7) Manufacturers are not required to use the following monitors in determining the readiness status for the specific component or system:

(A) Circuit and out-of-range monitors that are required to be continuous;

(B) Gasoline and diesel exhaust gas sensor feedback monitors specified in sections (e)(9.2.1)(A)(iii), (e)(9.2.1)(B)(iii), (e)(9.2.2)(C), (f)(8.2.1)(C), and (f)(8.2.2)(E);

(C) Diesel feedback control monitors specified in sections (e)(1.2.4), (e)(3.2.4), (e)(4.2.5), (e)(6.2.2)(D), (e)(7.2.3), and (e)(8.2.7);

(D) Gasoline fuel system monitors specified in sections (f)(1.2.1)(A), (f)(1.2.1)(B), (f)(1.2.2), (f)(1.2.4), and (f)(1.2.5).

(4.2) Data Stream: The following signals shall be made available on demand through the standardized data link connector in accordance with SAE J1979/J1939 specifications. The actual signal value shall always be used instead of a default or limp home value.

(4.2.1) For all gasoline engines:

(A) Calculated load value, engine coolant temperature, engine speed, vehicle speed, time elapsed since engine start; and

(B) Absolute load, fuel level (if used to enable or disable any other diagnostics), barometric pressure (directly measured or estimated), engine control module system voltage, commanded equivalence ratio; and

(C) Number of stored confirmed fault codes, catalyst temperature (if directly measured or estimated for purposes of enabling the catalyst monitor(s)), monitor status (i.e., disabled for the rest of this driving cycle, complete this driving cycle, or not complete this driving cycle) since last engine shut-off for each monitor used for readiness status, distance traveled (or engine run time for engines not utilizing vehicle speed information) while MIL activated, distance traveled (or engine run time for engines not utilizing vehicle speed information) since fault memory last cleared, and number of warm-up cycles since fault memory last cleared, OBD requirements to which the engine is certified (e.g., California OBD, EPA OBD, European OBD, non-OBD) and MIL status (i.e., commanded-on or commanded-off).

(4.2.2) For all diesel engines:

(A) Calculated load (engine torque as a percentage of maximum torque available at the current engine speed), driver's demand engine torque (as a percentage of maximum engine torque), actual engine torque (as a percentage of maximum engine torque), reference engine maximum torque, reference maximum engine torque as a function of engine speed (suspect parameter numbers (SPN) 539 through 543 defined by SAE

J1939 within parameter group number (PGN) 65251 for engine configuration), engine coolant temperature, engine oil temperature (if used for emission control or any OBD diagnostics), engine speed, time elapsed since engine start;

(B) Fuel level (if used to enable or disable any other diagnostics), vehicle speed (if used for emission control or any OBD diagnostics), barometric pressure (directly measured or estimated), engine control module system voltage;

(C) Number of stored confirmed/MIL-on fault codes, monitor status (i.e., disabled for the rest of this driving cycle, complete this driving cycle, or not complete this driving cycle) since last engine shut-off for each monitor used for readiness status, distance traveled (or engine run time for engines not utilizing vehicle speed information) while MIL activated, distance traveled (or engine run time for engines not utilizing vehicle speed information) since fault memory last cleared, number of warm-up cycles since fault memory last cleared, OBD requirements to which the engine is certified (e.g., California OBD, California OBD-child rating (i.e., for engines subject to (d)(7.1.2) or (d)(7.2.3)) EPA OBD, European OBD, non-OBD), MIL status (i.e., commanded-on or commanded-off);

(D) NOx NTE control area status (i.e., inside control area, outside control area, inside manufacturer-specific NOx NTE carve-out area, or deficiency active area), PM NTE control area status (i.e., inside control area, outside control area, inside manufacturer-specific PM NTE carve-out area, or deficiency active area);

(E) For 2013 and subsequent model year engines, normalized trigger for PM filter regeneration (SPN 5466 defined by SAE J1939 for 2016 and subsequent model year engines), PM filter regeneration status (SPN 3700 defined by SAE J1939 for 2016 and subsequent model year engines); and

(F) For 2013 and subsequent model year engines, average distance (or engine run time for engines not utilizing vehicle speed information) between PM filter regenerations.

(G) For 2016 and subsequent model year engines, fuel rate (mg/stroke), engine torque (including fan or accessory torque), and modeled exhaust flow (mass/time).

(H) For purposes of the calculated load and torque parameters in section (h)(4.2.2)(A) and the torque, fuel rate, and modeled exhaust flow parameters in section (h)(4.2.2)(G), manufacturers shall report the most accurate values that are calculated within the applicable electronic control unit (e.g., the engine control module). "Most accurate values", in this context, shall be of sufficient accuracy, resolution, and filtering to be used for the purposes of in-use emission testing with the engine still in a vehicle (e.g., using portable emission measurement equipment).

(4.2.3) For all engines so equipped:

(A) Absolute throttle position, relative throttle position, fuel control system status (e.g., open loop, closed loop), fuel trim, fuel pressure, ignition timing advance, fuel injection timing, intake air/manifold temperature, engine intercooler temperature, manifold absolute pressure, air flow rate from mass air flow sensor, secondary air status (upstream, downstream, or atmosphere), ambient air temperature, commanded purge valve duty cycle/position, commanded EGR valve duty cycle/position, actual EGR valve duty cycle/position, EGR error between actual and commanded, PTO status (active or not active), redundant absolute throttle position (for electronic throttle or other systems that utilize two or more sensors), absolute pedal position, redundant absolute pedal position, commanded throttle motor position, fuel rate, boost pressure, commanded/target boost pressure, turbo inlet air temperature, fuel rail pressure, commanded fuel rail pressure, PM filter inlet pressure, PM filter inlet temperature, PM filter outlet pressure, PM filter outlet temperature, PM filter delta pressure, exhaust pressure sensor output, exhaust gas temperature sensor output, injection control pressure, commanded injection control pressure, turbocharger/turbine speed, variable geometry turbo position, commanded variable geometry turbo position, turbocharger compressor inlet temperature, turbocharger compressor inlet pressure, turbocharger turbine inlet temperature, turbocharger turbine outlet temperature, wastegate valve position, glow plug lamp status;

(B) For 2013 and subsequent model year engines, EGR temperature, variable geometry turbo control status (e.g., open loop, closed loop), reductant level (e.g., urea tank fill level), alcohol fuel percentage, type of fuel currently being used, NOx adsorber regeneration status, NOx adsorber deSOx status, hybrid battery pack remaining charge;

(C) Oxygen sensor output, air/fuel ratio sensor output, NOx sensor output, evaporative system vapor pressure; and

(D) For 2013 and subsequent model year engines, PM sensor output and distance traveled while low/empty SCR reductant driver warning/inducement active.

(E) For 2016 and subsequent model year engines, reductant quality sensor output and corrected NOx sensor output (e.g., raw sensor signal corrected for estimated ammonia concentrations or auto-zero calculations and used by the applicable electronic control unit).

(4.3) Freeze Frame:

(4.3.1) "Freeze frame" information required to be stored pursuant to sections (d)(2.2.1)(D), (d)(2.2.2)(D), (e)(1.4.2)(D), (e)(2.4.2)(B), (f)(1.4.4), and (f)(2.4.3) shall be made available on demand through the standardized data link connector in accordance with SAE J1979/J1939-73 specifications.

(4.3.2) "Freeze frame" conditions must include the fault code which caused the data to be stored and all of the signals required in sections (h)(4.2.1)(A) and (4.2.2)(A). Freeze frame conditions shall also include all of the signals required on the engine in sections (h)(4.2.1)(B), (4.2.2)(B), (4.2.2)(E), (4.2.3)(A), and (4.2.3)(B) that are used for diagnostic or control purposes in the specific diagnostic or emission-critical powertrain control unit that stored the fault code.

(4.3.3) Only one frame of data is required to be recorded. Manufacturers may choose to store additional frames provided that at least the required frame can be read by a scan tool meeting SAE J1978 specifications or designed to communicate with an SAE J1939 network.

(4.4) Fault Codes:

(4.4.1) For vehicles using the ISO 15765-4 protocol for the standardized functions required in section (h):

(A) For all monitored components and systems, stored pending, confirmed, and permanent fault codes shall be made available through the diagnostic connector in a standardized format in accordance with SAE J1979 specifications. Standardized fault codes conforming to SAE J2012 shall be employed.

(B) The stored fault code shall, to the fullest extent possible, pinpoint the likely cause of the malfunction. To the extent feasible, manufacturers shall use separate fault codes for every diagnostic where the diagnostic and repair procedure or likely cause of the failure is different. In general, rationality and functional diagnostics shall use different fault codes than the respective circuit continuity diagnostics. Additionally, input component circuit continuity diagnostics shall use different fault codes for distinct malfunctions (e.g., out-of-range low, out-of-range high, open circuit).

(C) Manufacturers shall use appropriate SAE-defined fault codes of SAE J2012 (e.g., P0xxx, P2xxx) whenever possible. With Executive Officer approval, manufacturers may use manufacturer-defined fault codes in accordance with SAE J2012 specifications (e.g., P1xxx). Factors to be considered by the Executive Officer for approval shall include the lack of available SAE-defined fault codes, uniqueness of the diagnostic or monitored component, expected future usage of the diagnostic or component, and estimated usefulness in providing additional diagnostic and repair information to service technicians. Manufacturer-defined fault codes shall be used consistently (i.e., the same fault code may not be used to represent two different failure modes) across a manufacturer's entire product line.

(D) A pending or confirmed fault code (as required in sections (d) and (e) through (g)) shall be stored and available to an SAE J1978 scan tool within 10 seconds after a diagnostic has determined that a malfunction has

occurred. A permanent fault code shall be stored and available to an SAE J1978 scan tool no later than the end of an ignition cycle (including electronic control unit shutdown) in which the corresponding confirmed fault code causing the MIL to be illuminated has been stored.

(E) Pending fault codes:

(i) Pending fault codes for all components and systems (including continuously and non-continuously monitored components) shall be made available through the diagnostic connector in accordance with SAE J1979 specifications (e.g., Mode/Service $07).

(ii) A pending fault code(s) shall be stored and available through the diagnostic connector for all currently malfunctioning monitored component(s) or system(s), regardless of the MIL illumination status or confirmed fault code status (e.g., even after a pending fault has matured to a confirmed fault code and the MIL is illuminated, a pending fault code shall be stored and available if the most recent monitoring event indicates the component is malfunctioning).

(iii) Manufacturers using alternate statistical protocols for MIL illumination as allowed in section (d)(2.2.1)(C) shall submit to the Executive Officer a protocol for setting pending fault codes. The Executive Officer shall approve the proposed protocol upon determining that, overall, it is equivalent to the requirements in sections (h)(4.4.1)(E)(i) and (ii) and that it effectively provides service technicians with a quick and accurate indication of a pending failure.

(F) Permanent fault codes:

(i) Permanent fault codes for all components and systems shall be made available through the diagnostic connector in a standardized format that distinguishes permanent fault codes from both pending fault codes and confirmed fault codes.

(ii) A confirmed fault code shall be stored as a permanent fault code no later than the end of the ignition cycle and subsequently at all times that the confirmed fault code is commanding the MIL on (e.g., for currently failing systems but not during the 40 warm-up cycle self-healing process described in section (d)(2.3.1)(B)).

(iii) Permanent fault codes shall be stored in NVRAM and may not be erasable by any scan tool command (generic or enhanced) or by disconnecting power to the on-board computer.

(iv) Permanent fault codes may not be erased when the control module containing the permanent fault code is reprogrammed unless the readiness bits (refer to section (h)(4.1)) for all monitored components and systems in all modules that reported supported readiness for a

readiness bit other than the comprehensive components readiness bit are set to "not complete" in conjunction with the reprogramming event.

(v) The OBD system shall have the ability to store a minimum of four current confirmed fault codes as permanent fault codes in NVRAM. If the number of confirmed fault codes currently commanding the MIL on exceeds the maximum number of permanent fault codes that can be stored, the OBD system shall store the earliest detected confirmed fault codes as permanent fault codes. If additional confirmed fault codes are stored when the maximum number of permanent fault codes is already stored in NVRAM, the OBD system may not replace any existing permanent fault code with the additional confirmed fault codes.

(4.4.2) For vehicles using the SAE J1939 protocol for the standardized functions required in section (h):

(A) For all monitored components and systems, stored pending, MIL-on, and previously MIL-on fault codes shall be made available through the diagnostic connector in a standardized format in accordance with SAE J1939 specifications (i.e., Diagnostic Message (DM) 6, DM12, and DM23). Standardized fault codes conforming to SAE J1939 shall be employed.

(B) The stored fault code shall, to the fullest extent possible, pinpoint the likely cause of the malfunction. To the extent feasible, manufacturers shall use separate fault codes for every diagnostic where the diagnostic and repair procedure or likely cause of the failure is different. In general, rationality and functional diagnostics shall use different fault codes than the respective circuit continuity diagnostics. Additionally, input component circuit continuity diagnostics shall use different fault codes for distinct malfunctions (e.g., out-of-range low, out-of-range high, open circuit).

(C) Manufacturers shall use appropriate SAE-defined fault codes of SAE J939 whenever possible. With Executive Officer approval, manufacturers may use manufacturer-defined fault codes in accordance with SAE J1939 specifications. Factors to be considered by the Executive Officer for approval shall include the lack of available SAE-defined fault codes, uniqueness of the diagnostic or monitored component, expected future usage of the diagnostic or component, and estimated usefulness in providing additional diagnostic and repair information to service technicians. Manufacturer-defined fault codes shall be used consistently (i.e., the same fault code may not be used to represent two different failure modes) across a manufacturer's entire product line.

(D) A pending or MIL-on fault code (as required in sections (d), (e), and (g)) shall be stored and available to an SAE J1939 scan tool within 10 seconds after a diagnostic has determined that a malfunction has occurred. A permanent fault code shall be stored and available to an SAE J1939 scan tool no later than the end of an ignition cycle (including electronic control

unit shutdown) in which the corresponding MIL-on fault code causing the MIL to be illuminated has been stored.

(E) Pending fault codes:

(i) Pending fault codes for all components and systems (including continuously and non-continuously monitored components) shall be made available through the diagnostic connector in accordance with SAE J1939 specifications (i.e., DM6).

(ii) Manufacturers using alternate statistical protocols for MIL illumination as allowed in section (d)(2.2.2)(C) shall submit to the Executive Officer a protocol for setting pending fault codes. The Executive Officer shall approve the proposed protocol upon determining that, overall, it is equivalent to the requirements in sections (h)(4.4.2)(E)(i) and that it effectively provides service technicians with a quick and accurate indication of a pending failure.

(F) Permanent fault codes:

(i) Permanent fault codes for all components and systems shall be made available through the diagnostic connector in a standardized format that distinguishes permanent fault codes from pending fault codes, MIL-on fault codes, and previously MIL-on fault codes.

(ii) A MIL-on fault code shall be stored as a permanent fault code no later than the end of the ignition cycle and subsequently at all times that the MIL-on fault code is commanding the MIL on (e.g., for currently failing systems).

(iii) Permanent fault codes shall be stored in NVRAM and may not be erasable by any scan tool command (generic or enhanced) or by disconnecting power to the on-board computer.

(iv) Permanent fault codes may not be erased when the control module containing the permanent fault codes is reprogrammed unless the readiness bits (refer to section (h)(4.1)) for all monitored components and systems in all modules that reported supported readiness for a readiness bit other than the comprehensive components readiness bit are set to "not complete" in conjunction with the reprogramming event.

(v) The OBD system shall have the ability to store a minimum of four current MIL-on fault codes as permanent fault codes in NVRAM. If the number of MIL-on fault codes currently commanding the MIL on exceeds the maximum number of permanent fault codes that can be stored, the OBD system shall store the earliest detected MIL-on fault codes as permanent fault codes. If additional MIL-on fault codes are stored when the maximum number of permanent fault codes is already stored in NVRAM, the OBD system may not replace any existing permanent fault code with the additional MIL-on fault codes.

(4.5) Test Results:

(4.5.1) Except as provided in section (h)(4.5.7), for all monitored components and systems identified in sections (e)(1) through (f)(9), results of the most recent monitoring of the components and systems and the test limits established for monitoring the respective components and systems shall be stored and available through the data link in accordance with the standardized format specified in SAE J1979 for the ISO 15765-4 protocol or SAE J1939.

(4.5.2) The test results shall be reported such that properly functioning components and systems (e.g., "passing" systems) do not store test values outside of the established test limits. Test limits shall include both minimum and maximum acceptable values and shall be defined so that a test result equal to either test limit is a "passing" value, not a "failing" value.

(4.5.3) The test results shall be standardized such that the name of the monitored component (e.g., catalyst bank 1) can be identified by a generic scan tool and the test results and limits can be scaled and reported with the appropriate engineering units by a generic scan tool.

(4.5.4) The test results shall be stored until updated by a more recent valid test result or the fault memory of the OBD system computer is cleared.

(4.5.5) If the OBD system fault memory is cleared:

(A) For vehicles using the ISO 15765-4 protocol for the standardized functions required in section (h), all test results shall report values of zero for the test result and test limits. The test results shall be updated once the applicable monitor has run and has valid test results and limits to report.

(B) For vehicles using the SAE J1939 protocol for the standardized functions required in section (h):

(i) For 2010 through 2015 model year engines, all test results shall either (a) report values of zero for the test results and test limits, or (b) report values corresponding to 'test not complete' in accordance with SAE J1939-73 specifications. The test results shall be updated once the applicable monitor has run and has valid test results and limits to report.

(ii) For 2016 and subsequent model year engines, all test results shall report values corresponding to 'test not complete' in accordance with SAE J1939-73 specifications. The test results shall be updated once the applicable monitor has run and has valid test results and limits to report.

(4.5.6) All test results and test limits shall always be reported. The OBD system shall store and report unique test results for each separate diagnostic.

(4.5.7) The requirements of section (h)(4.5) do not apply to gasoline fuel system monitors specified under sections (f)(1.2.1)(A), (f)(1.2.1)(B), (f)(1.2.2),

(f)(1.2.4), and (f)(1.2.5), exhaust gas sensor monitors specified under sections (e)(9.2.1)(A)(iii), (e)(9.2.1)(B)(iii), (e)(9.2.2)(C), (f)(8.2.1)(C), and (f)(8.2.2)(E), cold start emission reduction strategy monitors, circuit and out-of-range monitors that are required to be continuous, and diesel feedback control monitors specified under sections (e)(1.2.4), (e)(3.2.4), (e)(4.2.5), (e)(6.2.2)(D), (e)(7.2.3), and (e)(8.2.7).

(4.6) Software Calibration Identification:

(4.6.1) Except as provided for in section (h)(4.6.3), on all vehicles, a single software calibration identification number (CAL ID) for each diagnostic or emission critical control unit(s) shall be made available through the standardized data link connector in accordance with the SAE J1979/J1939 specifications.

(4.6.2) A unique CAL ID shall be used for every emission-related calibration and/or software set having at least one bit of different data from any other emission-related calibration and/or software set. Control units coded with multiple emission or diagnostic calibrations and/or software sets shall indicate a unique CAL ID for each variant in a manner that enables an off-board device to determine which variant is being used by the vehicle. Control units that utilize a strategy that will result in MIL illumination if the incorrect variant is used (e.g., control units that contain variants for manual and automatic transmissions but will illuminate the MIL if the variant selected does not match the type of transmission on the vehicle) are not required to use unique CAL IDs.

(4.6.3) Manufacturers may request Executive Officer approval to respond with more than one CAL ID per diagnostic or emission critical powertrain control unit. Executive Officer approval of the request shall be based on the method used by the manufacturer to ensure each control unit will respond to a generic scan tool with the CAL IDs in order of highest to lowest priority with regards to areas of the software most critical to emission and OBD system performance.

(4.7) Software Calibration Verification Number:

(4.7.1) All vehicles shall use an algorithm to calculate a single calibration verification number (CVN) that verifies the on-board computer software integrity for each diagnostic or emission critical electronic control unit. The CVN shall be made available through the standardized data link connector in accordance with the SAE J1979/J1939 specifications. The CVN shall be capable of being used to determine if the emission-related software and/or calibration data are valid and applicable for that vehicle and CAL ID.

(4.7.2) One CVN shall be made available for each CAL ID made available. For diagnostic or emission critical powertrain control units with more than one CAL ID, each CVN shall be output to a generic scan tool in the same order

as the CAL IDs are output to the generic scan tool to allow the scan tool to match each CVN to the corresponding CAL ID.

(4.7.3) Manufacturers shall submit information for Executive Officer approval of the algorithm used to calculate the CVN. Executive Officer approval of the algorithm shall be based on the complexity of the algorithm and the determination that the same CVN is difficult to achieve with modified calibration values.

(4.7.4) The CVN shall be calculated at least once per ignition cycle and stored until the CVN is subsequently updated. The stored CVN value may not be erased when fault memory is erased by a generic scan tool in accordance with SAE J1979/J1939 specifications or during normal vehicle shut down (i.e., key off, engine off).

(4.7.5) When a CVN request message is received by the on-board computer, the stored CVN value shall be made available through the data link connector to a generic scan tool. Except as provided for below, the on-board computer may not use delayed timing in sending the CVN and may not respond with a message indicating that the CVN value is not currently available. If the CVN request message is received immediately following erasure of the stored CVN value (i.e., within the first 120 seconds of engine operation after a reprogramming event or a non-volatile memory clear or within the first 120 seconds of engine operation after a volatile memory clear or battery disconnect), the on-board computer may respond with one or more messages directing the scan tool to wait or resend the request message after the delay. Such messages and delays shall conform to the specifications for transmitting CVN data contained in SAE J1979 or J1939, whichever applies.

(4.7.6) For purposes of Inspection and Maintenance (I/M) testing, manufacturers shall make the CVN and CAL ID combination information available for all vehicles in a standardized electronic format that allows for off-board verification that the CVN is valid and appropriate for a specific vehicle and CAL ID. The standardized electronic format is detailed in Attachment F of ARB Mail-Out #MSC 09-22, July 7, 2009, incorporated by reference. Manufacturers shall submit the CVN and CAL ID information to the Executive Officer not more than 25 days after the close of a calendar quarter.

(4.8) Vehicle and Engine Identification Numbers:

(4.8.1) All vehicles shall have the vehicle identification number (VIN) available in a standardized format through the standardized data link connector in accordance with SAE J1979/J1939 specifications. Only one electronic control unit per vehicle shall report the VIN to an SAE J1978/J1939 scan tool.

(4.8.2) All 2013 and subsequent model year engines shall have the engine serial number (ESN) available in a standardized format through the standardized data link connector. Only one electronic control unit per vehicle shall report the ESN to an SAE J1978/J1939 scan tool.

(4.8.3) If the VIN or ESN is reprogrammable, in conjunction with reprogramming of the VIN or the ESN, the OBD system shall erase all emission-related diagnostic information identified in section (h)(4.10.1) in all control modules that reported supported readiness for a readiness bit other than the comprehensive components readiness bit.

(4.9) ECU Name: For 2013 and subsequent model year engines, the name of each electronic control unit that responds to an SAE J1978/J1939 scan tool with a unique address or identifier shall be communicated in a standardized format in accordance with SAE J1979/J1939 (e.g., ECUNAME in Service/Mode $09, InfoType $0A in SAE J1979).

(4.10) Erasure of Emission-Related Diagnostic Information:

(4.10.1) For purposes of section (h)(4.10), "emission-related diagnostic information" includes all the following:

(A) Readiness status (section (h)(4.1))

(B) Data stream information (section (h)(4.2)) including number of stored confirmed/MIL-on fault codes, distance traveled while MIL activated, number of warm-up cycles since fault memory last cleared, and distance traveled since fault memory last cleared.

(C) Freeze frame information (section (h)(4.3))

(D) Pending, confirmed, MIL-on, and previously MIL-on fault codes (section (h)(4.4.))

(E) Test results (section (h)(4.5))

(4.10.2) For all vehicles, the emission-related diagnostic information shall be erased if commanded by a scan tool (generic or enhanced) and may be erased if the power to the on-board computer is disconnected. Except as provided for in sections (h)(4.4.1)(F)(iv), (h)(4.4.2)(F)(iv), and (h)(4.8.3), if any of the emission-related diagnostic information is commanded to be erased by a scan tool (generic or enhanced), all emission-related diagnostic information from all diagnostic or emission critical control units shall be erased. The OBD system may not allow a scan tool to erase a subset of the emission-related diagnostic information (e.g., the OBD system may not allow a scan tool to erase only one of three stored fault codes or only information from one control unit without erasing information from the other control unit(s)).

(5) Tracking Requirements:

(5.1) In-use Performance Ratio Tracking Requirements:

(5.1.1) For each monitor required in sections (e) through (g) to separately report an in-use performance ratio, manufacturers shall implement software algorithms to report a numerator and denominator in the standardized format specified below and in accordance with the SAE J1979/J1939 specifications.

(5.1.2) Numerical Value Specifications:

(A) For the numerator, denominator, general denominator, and ignition cycle counter:

(i) Each number shall have a minimum value of zero and a maximum value of 65,535 with a resolution of one.

(ii) Each number shall be reset to zero only when a non-volatile random access memory (NVRAM) reset occurs (e.g., reprogramming event) or, if the numbers are stored in keep-alive memory (KAM), when KAM is lost due to an interruption in electrical power to the control module (e.g., battery disconnect). Numbers may not be reset to zero under any other circumstances including when a scan tool command to clear fault codes or reset KAM is received.

(iii) If either the numerator or denominator for a specific component reaches the maximum value of 65,535 ±2, both numbers shall be divided by two before either is incremented again to avoid overflow problems.

(iv) If the ignition cycle counter reaches the maximum value of 65,535 ±2, the ignition cycle counter shall rollover and increment to zero on the next ignition cycle to avoid overflow problems.

(v) If the general denominator reaches the maximum value of 65,535 ±2, the general denominator shall rollover and increment to zero on the next driving cycle that meets the general denominator definition to avoid overflow problems.

(vi) If a vehicle is not equipped with a component (e.g., oxygen sensor bank 2, secondary air system), the corresponding numerator and denominator for that specific component shall always be reported as zero.

(B) For the ratio:

(i) The ratio shall have a minimum value of zero and a maximum value of 7.99527 with a resolution of 0.000122.

(ii) A ratio for a specific component shall be considered to be zero whenever the corresponding numerator is equal to zero and the

corresponding denominator is not zero.

(iii) A ratio for a specific component shall be considered to be the maximum value of 7.99527 if the corresponding denominator is zero or if the actual value of the numerator divided by the denominator exceeds the maximum value of 7.99527.

(5.2) Engine Run Time Tracking Requirements:

(5.2.1) For all gasoline and diesel engines, manufacturers shall implement software algorithms to individually track and report in a standardized format the engine run time while being operated in the following conditions:

(A) Total engine run time;

(B) Total idle run time (with "idle" defined as accelerator pedal released by driver, engine speed greater than or equal to 50 to 150 rpm below the normal warmed-up idle speed (as determined in the drive position for vehicles equipped with an automatic transmission), PTO not active, and either vehicle speed less than or equal to one mile per hour or engine speed less than or equal to 200 rpm above normal warmed-up idle), and;

(C) Total run time with PTO active;

(D) For 2013 and subsequent model year diesel engines only:

(i) total run time with EI-AECD #1active;

(ii) total run time with EI-AECD #2 active; and so on up to

(iii) total run time with EI-AECD #n active.

(5.2.2) Numerical Value Specifications: For each counter specified in section (h)(5.2.1):

(A) Each number shall conform to the standardized format specified in SAE J1979/J1939.

(B) Each number shall be reset to zero only when a non-volatile memory reset occurs (e.g., reprogramming event). Numbers may not be reset to zero under any other circumstances including when a scan tool (generic or enhanced) command to clear fault codes or reset KAM is received.

(C) If any of the individual counters reach the maximum value, all counters shall be divided by two before any are incremented again to avoid overflow problems.

(5.2.3) Specifications of EI-AECDs

(A) For purposes of section (h)(5.2.3), the following terms shall be defined as follows:

(i) "Purpose" is defined as the objective of the EI-AECD when it is activated (e.g., EGR valve protection);

(ii) "Action" is defined as a specific component/element act that is commanded when the EI-AECD is activated (e.g., EGR system is derated);

(iii) "Parameter" is defined as a component/element (e.g., ECT, oil temperature) used to determine when to activate the EI-AECD; and

(iv) "Condition" is defined as the specific characteristic/state exhibited by the parameter (e.g., ECT above 100 degrees Celsius) that triggers activation of the EI-AECD.

(B) Each unique combination of action, parameter, and condition within a purpose shall be tracked as a separate EI-AECD and increment the timer(s) at all times the condition necessary to activate the EI-AECD is present.

(i) For EI-AECDs that implement an action of variable degree based on the varying characteristics of a parameter (e.g., derate EGR more aggressively as engine oil temperature continues to increase), the EI-AECD shall be tracked by incrementing two separate timers within a single EI-AECD (e.g., EI-AECD #1 timer 1 and EI-AECD #1 timer 2) as follows:

a. The first of the two timers shall be incremented whenever the EI-AECD is commanding some amount of reduced emission control effectiveness up to but not including 75 percent of the maximum reduced emission control effectiveness that the EI-AECD is capable of commanding during in-use vehicle or engine operation. For example, an overheat protection strategy that progressively derates EGR and eventually shuts off EGR as oil temperature increases would accumulate time for the first timer from the time derating of EGR begins up to the time that EGR is derated 75 percent. As a second example, an overheat protection strategy that advances fuel injection timing progressively up to a maximum advance of 15 degrees crank angle as the engine coolant temperature increases would accumulate time for the first timer from the time advance is applied up to the time that advance reaches 11.25 degrees (75 percent of the maximum 15 degrees).

b. The second of the two timers shall be incremented whenever the EI-AECD is commanding 75 percent or more of the maximum reduced emission control effectiveness that the EI-AECD is capable of commanding during in-use vehicle or engine operation. For example, the second timer for the first example EI-AECD identified in section (h)(5.2.3)(B)(i) would accumulate time from the time that EGR is derated 75 percent up to and including when EGR is completely shut off. For the second example EI-AECD identified in section (h)(5.2.3)(B)(i), the second timer would accumulate time from the time fuel injection timing advance is at 11.25 degrees up to

and including the maximum advance of 15 degrees.

(C) A manufacturer may request Executive Officer approval to combine multiple unique actions, parameters, and/or conditions to be tracked within a single EI-AECD. The manufacturer shall submit a plan for combining, tracking, and incrementing the EI-AECD to the Executive Officer for approval. Executive Officer approval of the plan shall be based on the effectiveness and the equivalence of the incrementing plan to determine the amount of EI-AECD activity per condition relative to the measure of EI-AECD activity under section (h)(5.2.3)(B).

(D) For EI-AECDs that are activated solely due to elevation, the timer shall be incremented only for the portion of EI-AECD activation when the elevation is below 8000 feet (e.g., the timer for an EI-AECD that is activated when the elevation is above 5000 feet shall be incremented only when the EI-AECD is active and the elevation is below 8000 feet).

(E) For EI-AECDs that are initially activated due to engine warm-up and are subsequently reactivated after the engine has warmed up, the timer shall be incremented only when the EI-AECD is active after the initial engine warm-up (e.g., an EI-AECD that turns off an emission control at low engine coolant temperature would not increment the timer during initial warm-up but would increment the timer if coolant temperature subsequently dropped below the low temperature and reactivated the EI-AECD later in the drive cycle).

(F) If more than one EI-AECD is currently active, the timers for both EI-AECDs shall accumulate time, regardless if there is overlap or redundancy in the commanded action (e.g., two different EI-AECDs independently but simultaneously commanding EGR off shall both accumulate time in their respective timers).

(i) *Monitoring System Demonstration Requirements for Certification.*

(1) General.

(1.1) Certification requires that manufacturers submit emission test data from one or more durability demonstration test engines (test engines).

(1.2) The Executive Officer may approve other demonstration protocols if the manufacturer can provide comparable assurance that the malfunction criteria are chosen based on meeting the malfunction criteria requirements and that the timeliness of malfunction detection is within the constraints of the applicable monitoring requirements.

(1.3) For flexible fuel engines capable of operating on more than one fuel or fuel combinations, the manufacturer shall submit a plan for providing emission test data to the Executive Officer for approval. The Executive Officer shall approve the plan if it is determined to be representative of expected in-use fuel or fuel combinations and provides accurate and timely evaluation of the monitored

systems.

(2) Selection of Test Engines:

(2.1) Prior to submitting any applications for certification for a model year, a manufacturer shall notify the Executive Officer of the engine families and engine ratings within each family planned for that model year. The Executive Officer will then select the engine family(ies) and the specific engine rating within the engine family(ies) that the manufacturer shall use as demonstration test engines to provide emission test data. The selection of test vehicles for production vehicle evaluation, as specified in section (l)(2), may take place during this selection process.

(2.2) Number of test engines:

(2.2.1) For the 2010 model year, a manufacturer shall provide emission test data of a test engine from the OBD parent rating.

(2.2.2) For the 2011 and 2012 model years, a manufacturer certifying one to seven engine families in a model year shall provide emission test data of a test engine from one OBD child rating. A manufacturer certifying eight or more engine families in a model year shall provide emission test data of test engines from two OBD child ratings. The Executive Officer may waive the requirement for submittal of data of one or more of the test engines if data have been previously submitted for all of the OBD parent and OBD child ratings.

(2.2.3) For the 2013 and subsequent model years, a manufacturer certifying one to five engine families in a model year shall provide emission test data of a test engine from one engine rating. A manufacturer certifying six to ten engine families in a model year shall provide emission test data from test engines from two engine ratings. A manufacturer certifying eleven or more engine families in a model year shall provide emission test data of test engines from three engine ratings. The Executive Officer may waive the requirement for submittal of data of one or more of the test engines if data have been previously submitted for all of the engine ratings.

(2.2.4) For a given model year, a manufacturer may elect to provide emission data of test engines from more engine ratings than required by section (i)(2.2.1) through (2.2.3). For each additional engine rating tested in that given model year, the Executive Officer shall reduce the number of engine ratings required for testing in one future model year under sections (i)(2.2.2) through (2.2.3) by one.

(2.3) Aging and data collection of diesel test engines:

(2.3.1) For 2010 through 2012 model year test engines, a manufacturer shall use an engine aged for a minimum of 125 hours plus exhaust aftertreatment emission controls aged by an accelerated aging process to be representative of full useful life. Manufacturers are required to submit for

Executive Officer approval a description of the accelerated aging process and/or supporting data. The Executive Officer shall approve the process upon determining that the submitted description and/or data demonstrate that the process ensures that deterioration of the exhaust aftertreatment emission controls is stabilized sufficiently such that it is representative of the manufacturer's best estimates for the performance of the emission control at the end of the useful life. The Executive Officer may not require manufacturers to provide actual in-use or high mileage data to verify or validate that the aging is equivalent to full useful life for purposes of section (i)(2.3.1).

(2.3.2) For 2013 through 2015 model year test engines:

(A) A manufacturer shall collect emission and deterioration data from an actual high mileage system(s) (consisting of the engine, engine emission controls, and aftertreatment) to validate its accelerated aging process. The manufacturer shall collect the data from a 2010 or newer model year system that is the most representative of system designs planned for the 2013 model year and has a minimum actual mileage of full useful life or 185,000 miles, whichever is lower. The manufacturer shall collect and report the data to ARB prior to the end of 2011. The manufacturer shall submit a plan for system selection, procurement, and data collection to the Executive Officer for approval prior to proceeding with the data collection. The Executive Officer shall approve the plan upon determining that the submitted description will result in the manufacturer gathering data necessary to quantify emission performance and deterioration of the system elements in a manner that will allow comparison to deterioration and performance levels achieved with the manufacturer's accelerated aging process.

(B) For testing of 2013 through 2015 model year engines, a manufacturer shall use a system (engine, engine emission controls, and aftertreatment) aged by an accelerated aging process to be representative of full useful life. Manufacturers are required to submit for Executive Officer approval a description of the accelerated aging process and supporting data. The Executive Officer shall approve the process upon determining that the submitted description and data demonstrate that the aging process will result in a system representative of the manufacturer's best estimates of the system performance at full useful life and that the manufacturer has utilized the data collected under section (i)(2.3.2)(A) to validate the correlation of the aging process to actual high mileage systems up to a minimum of full useful life or 185,000 miles.

(2.3.3) For 2016 and subsequent model year test engines:

(A) A manufacturer shall collect emission and deterioration data from an actual high mileage system(s) (consisting of the engine, engine emission controls, and aftertreatment) to validate its accelerated aging process. The manufacturer shall collect the data from a 2010 or newer model year

system that is the most representative of system designs planned for the 2016 model year and has a minimum actual mileage of full useful life. The manufacturer shall collect and report the data to ARB prior to the end of 2014. The manufacturer shall submit a plan for system selection, procurement, and data collection to the Executive Officer for approval prior to proceeding with the data collection. The Executive Officer shall approve the plan upon determining that the submitted description will result in the manufacturer gathering data necessary to quantify emission performance and deterioration of the system elements in a manner that will allow comparison to deterioration and performance levels achieved with the manufacturer's accelerated aging process.

(B) For testing of 2016 and subsequent model year engines, a manufacturer shall use a system (engine, engine emission controls, and aftertreatment) aged by an accelerated aging process to be representative of full useful life. Manufacturers are required to submit for Executive Officer approval a description of the accelerated aging process and supporting data. The Executive Officer shall approve the process upon determining that the submitted description and data demonstrate that the aging process will result in a system representative of the manufacturer's best estimates of the system performance at full useful life and that the manufacturer has utilized the data collected under section (i)(2.3.3)(A) to validate the correlation of the aging process to actual high mileage systems up to a minimum of full useful life.

(2.4) Aging of gasoline engines: For the test engine(s), a manufacturer shall use a certification emission durability test engine(s) system (i.e., consisting of the engine, engine emission controls, and aftertreatment), a representative high mileage engine(s) system, or an engine(s) system aged to the end of the full useful life using an ARB-approved alternative durability procedure (ADP).

(3) Required Testing:

Except as provided below, the manufacturer shall perform single-fault testing based on the applicable test with the following components/systems set at their malfunction criteria limits as determined by the manufacturer for meeting the requirements of sections (e), (f), and (g) or sections (d)(7.1.2) and (d)(7.2.3) for extrapolated OBD systems.

(3.1) Required testing for Diesel/Compression Ignition Engines:

(3.1.1) Fuel System: The manufacturer shall perform a separate test for each malfunction limit established by the manufacturer for the fuel system parameters (e.g., fuel pressure, injection timing) and calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in sections (e)(1.2.1) through (e)(1.2.3). When performing a test for a specific parameter, the fuel system shall be operating at the malfunction criteria limit for the applicable parameter only. All other parameters shall be with normal characteristics. In conducting the fuel system demonstration tests,

the manufacturer may use computer modifications to cause the fuel system to operate at the malfunction limit if the manufacturer can demonstrate to the Executive Officer that the computer modifications produce test results equivalent to an induced hardware malfunction.

(3.1.2) Misfire Monitoring: For 2013 model year engines subject to section (e)(2.2.5), the manufacturer shall perform a test at the malfunction limit specified in section (e)(2.2.5). A misfire demonstration test is not required for diesel engines not subject to section (e)(2.2.5).

(3.1.3) EGR System: The manufacturer shall perform a test at each flow, slow response, and cooling limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in sections (e)(3.2.1) through (3.2.3) and (e)(3.2.5). In conducting the EGR cooler performance demonstration test, the EGR cooler(s) being evaluated shall be deteriorated to the applicable malfunction criteria using methods established by the manufacturer in accordance with section (e)(3.2.9). In conducting the EGR system slow response demonstration tests, the manufacturer may use computer modifications to cause the EGR system to operate at the malfunction limit if the manufacturer can demonstrate to the Executive Officer that the computer modifications produce test results equivalent to an induced hardware malfunction or that there is no reasonably feasible method to induce a hardware malfunction.

(3.1.4) Boost Pressure Control System: The manufacturer shall perform a test at each boost, response, and cooling limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in sections (e)(4.2.1) through (4.2.3) and (e)(4.2.4). In conducting the charge air undercooling demonstration test, the charge air cooler(s) being evaluated shall be deteriorated to the applicable malfunction limit established by the manufacturer in section (e)(4.2.4) using methods established by the manufacturer in accordance with section (e)(4.2.8).

(3.1.5) NMHC Catalyst: The manufacturer shall perform a separate test for each monitored NMHC catalyst(s) that is used for a different purpose (e.g., oxidation catalyst upstream of a PM filter, NMHC catalyst used downstream of an SCR catalyst). The catalyst(s) being evaluated shall be deteriorated to the applicable malfunction limit(s) established by the manufacturer and calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in section (e)(5.2.2)(A) and (e)(5.2.2)(B) using methods established by the manufacturer in accordance with section (e)(5.2.4). For each monitored NMHC catalyst(s), the manufacturer shall also demonstrate that the OBD system will detect a catalyst malfunction with the catalyst at its maximum level of deterioration (i.e., the substrate(s) completely removed from the catalyst container or "empty" can). Emission data are not required for the empty can demonstration.

(3.1.6) NOx Catalyst: The manufacturer shall perform a separate test for each monitored NOx catalyst(s) that is used for a different purpose (e.g., passive

lean NOx catalyst, SCR catalyst). The catalyst(s) being evaluated shall be deteriorated to the applicable malfunction limit(s) established by the manufacturer and calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in sections (e)(6.2.1) and (e)(6.2.2)(A) using methods established by the manufacturer in accordance with section (e)(6.2.3). For each monitored NOx catalyst(s), the manufacturer shall also demonstrate that the OBD system will detect a catalyst malfunction with the catalyst at its maximum level of deterioration (i.e., the substrate(s) completely removed from the catalyst container or "empty" can). Emission data are not required for the empty can demonstration.

(3.1.7) NOx Adsorber: The manufacturer shall perform a test using a NOx adsorber(s) deteriorated to the malfunction limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in section (e)(7.2.1). The manufacturer shall also demonstrate that the OBD system will detect a NOx adsorber malfunction with the NOx adsorber at its maximum level of deterioration (i.e., the substrate(s) completely removed from the container or "empty" can). Emission data are not required for the empty can demonstration.

(3.1.8) PM Filter: The manufacturer shall perform a test using a PM filter(s) deteriorated to each applicable malfunction limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in sections (e)(8.2.1), (e)(8.2.2), and (e)(8.2.4)(A). The manufacturer shall also demonstrate that the OBD system will detect a PM filter malfunction with the filter at its maximum level of deterioration (i.e., the filter(s) completely removed from the filter container or "empty" can). Emission data are not required for the empty can demonstration.

(3.1.9) Exhaust Gas Sensor: The manufacturer shall perform a test for each exhaust gas sensor parameter at each malfunction limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in sections (e)(9.2.1)(A)(i), (e)(9.2.1)(B)(i)a. through b., and (e)(9.2.2)(A)(i) through (ii). When performing a test, all exhaust gas sensors used for the same purpose (e.g., for the same feedback control loop, for the same control feature on parallel exhaust banks) shall be operating at the malfunction criteria limit for the applicable parameter only. All other exhaust gas sensor parameters shall be with normal characteristics.

(3.1.10) VVT System: The manufacturer shall perform a test at each target error limit and slow response limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in sections (e)(10.2.1) and (e)(10.2.2). In conducting the VVT system demonstration tests, the manufacturer may use computer modifications to cause the VVT system to operate at the malfunction limit if the manufacturer can demonstrate to the Executive Officer that the computer modifications produce test results equivalent to an induced hardware malfunction.

(3.1.11) Cold Start Emission Reduction Strategy: The manufacturer shall perform

a test at the malfunction limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) for the system or for each component monitored according to section (e)(11.2.2).

(3.1.12) For each of the testing requirements of section (i)(3.1), if the manufacturer has established that only a functional check is required because no failure or deterioration of the specific tested system could result in an engine's emissions exceeding the emission threshold malfunction criteria (e.g., 2.0 times any of the applicable standards), the manufacturer is not required to perform a demonstration test; however the manufacturer is required to provide the data and/or engineering analysis used to determine that only a functional test of the system(s) is required.

(3.2) Required testing for Gasoline/Spark-Ignited Engines:

(3.2.1) Fuel System:

(A) For engines with adaptive feedback based on the primary fuel control sensor(s), the manufacturer shall perform a test with the adaptive feedback based on the primary fuel control sensor(s) at the rich limit(s) and a test at the lean limit(s) established by the manufacturer and calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in section (f)(1.2.1)(A). For purposes of fuel system testing, the fault(s) induced may result in a uniform distribution of fuel and air among the cylinders. Non-uniform distribution of fuel and air used to induce a fault may not cause misfire.

(B) For engines with feedback based on a secondary fuel control sensor(s) and subject to the malfunction criteria in section (f)(1.2.1)(B), the manufacturer shall perform a test with the feedback based on the secondary fuel control sensor(s) at the rich limit(s) and a test at the lean limit(s) established by the manufacturer and calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in section (f)(1.2.1)(B).

(C) For engines subject to the malfunction criteria in section (f)(1.2.1)(C) (monitoring of air-fuel ratio cylinder imbalance faults), the manufacturer shall perform a test at the malfunction limit(s) calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in section (f)(1.2.1)(C). The manufacturer shall perform the test at the rich limit and another test at the lean limit with a fault induced on the worst case cylinder for each limit. The manufacturer shall submit data and/or analysis demonstrating that a fault of the cylinder(s) will result in the worst case emissions for each malfunction limit.

(D) For other fuel metering or control systems, the manufacturer shall perform a test at the criteria limit(s).

(E) In conducting the fuel system demonstration tests, the manufacturer may use computer modifications to cause the fuel system to operate at the

malfunction limit if the manufacturer can demonstrate to the Executive Officer that the computer modifications produce test results equivalent to an induced hardware malfunction.

(3.2.2) Misfire: The manufacturer shall perform a test at the malfunction limit calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in section (f)(2.2.2).

(3.2.3) EGR System: The manufacturer shall perform a test at each flow limit calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in sections (f)(3.2.1) and (f)(3.2.2).

(3.2.4) Cold Start Emission Reduction Strategy: The manufacturer shall perform a test at the malfunction limit calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) for each component monitored according to section (f)(4.2.1)(A) or (f)(4.2.2)(B).

(3.2.5) Secondary Air System: The manufacturer shall perform a test at each flow limit calibrated to the emission threshold malfunction criteria in sections (f)(5.2.1) and (f)(5.2.2).

(3.2.6) Catalyst: The manufacturer shall perform a test using a catalyst system deteriorated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in section (f)(6.2.1) using methods established by the manufacturer in accordance with section (f)(6.2.2). The manufacturer shall also demonstrate that the OBD system will detect a catalyst system malfunction with the catalyst system at its maximum level of deterioration (i.e., the substrate(s) completely removed from the catalyst container or "empty" can). Emission data are not required for the empty can demonstration.

(3.2.7) Exhaust Gas Sensor:

(A) The manufacturer shall perform a test with all primary oxygen sensors (conventional switching sensors and wide range or universal sensors) used for fuel control simultaneously possessing a response rate deteriorated to the malfunction limit calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in section (f)(8.2.1)(A). For conventional switching sensors, the manufacturer shall perform a test for each of the following malfunctions (1) the single worst case response rate malfunction among all symmetric and asymmetric patterns required by section (f)(8.2.1)(A), and (2) the worst case asymmetric response rate malfunction that results in delays during transitions from rich-to-lean or lean-to-rich sensor output. For wide range or universal sensors, the manufacturer shall perform a test for each of the following malfunctions: (1) the single worst case response rate malfunction among all symmetric and asymmetric patterns required by section (f)(8.2.1)(A), and (2) the symmetric response rate malfunction that results in delays during transitions from rich-to-lean and lean-to-rich sensor output. For systems

where the same response rate pattern meets the criteria of (1) and (2) above, only one demonstration test is required. For the response rate patterns not tested, the manufacturer is required to provide the data and/or engineering analysis used to determine that the tested response pattern for criterion (1) will result in the worst case emissions compared to all the other response rate malfunctions. Manufacturers shall also perform a test for any other oxygen sensor parameter under sections (f)(8.2.1)(A) and (f)(8.2.2)(A) that can cause engine emissions to exceed the emission threshold malfunction criteria (e.g., 1.5 times the applicable standards due to a shift in air/fuel ratio at which oxygen sensor switches, decreased amplitude). When performing additional test(s), all primary and secondary (if applicable) oxygen sensors used for fuel control shall be operating at the malfunction criteria limit for the applicable parameter only. All other primary and secondary oxygen sensor parameters shall be with normal characteristics.

(B) For engines utilizing sensors other than oxygen sensors for primary fuel control (e.g., hydrocarbon sensors), the manufacturer shall submit, for Executive Officer approval, a demonstration test plan for performing testing of all of the sensor parameters that can cause engine emissions to exceed the emission threshold malfunction criteria (e.g., 1.5 times the applicable standards). The Executive Officer shall approve the plan if it is determined that it will provide data that will assure proper performance of the diagnostics of the sensors, consistent with the intent of section (i).

(3.2.8) VVT System: The manufacturer shall perform a test at each target error limit and slow response limit calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in sections (f)(9.2.1) and (f)(9.2.2). In conducting the VVT system demonstration tests, the manufacturer may use computer modifications to cause the VVT system to operate at the malfunction limit if the manufacturer can demonstrate to the Executive Officer that the computer modifications produce test results equivalent to an induced hardware malfunction.

(3.2.9) For each of the testing requirements of section (i)(3.2), if the manufacturer has established that only a functional check is required because no failure or deterioration of the specific tested system could result in an engine's emissions exceeding the emission threshold malfunction criteria (e.g., 1.5 times any of the applicable standards), the manufacturer is not required to perform a demonstration test; however the manufacturer is required to provide the data and/or engineering analysis used to determine that only a functional test of the system(s) is required.

(3.3) Required Testing for All Engines:

(3.3.1) Other Emission Control Systems: The manufacturer shall conduct demonstration tests for all other emission control components (e.g., hydrocarbon traps, adsorbers) designed and calibrated to an emission threshold malfunction criteria (e.g., 1.5 times the applicable standards)

under the provisions of section (g)(4).

(3.3.2) For each of the testing requirements of section (i)(3.3), if the manufacturer has established that only a functional check is required because no failure or deterioration of the specific tested system could result in an engine's emissions exceeding the emission threshold malfunction criteria (e.g., 1.5 times any of the applicable standards), the manufacturer is not required to perform a demonstration test; however the manufacturer is required to provide the data and/or engineering analysis used to determine that only a functional test of the system(s) is required.

(3.4) The manufacturer may electronically simulate deteriorated components if the manufacturer can demonstrate to the Executive Officer that the computer modifications produce test results equivalent to an induced hardware malfunction but may not make any engine control unit modifications (unless otherwise provided above or exempted pursuant to this section) when performing demonstration tests. All equipment necessary to duplicate the demonstration test must be made available to ARB upon request. A manufacturer may request Executive Officer approval to electronically simulate a deteriorated component with engine control unit modifications. The Executive Officer shall approve the request upon determining the manufacturer has submitted data and/or engineering analysis demonstrating that is technically infeasible, very difficult, and/or resource intensive to implant the fault with modifications external to the engine control unit.

(3.5) For each of the testing requirements of (i)(3), when performing a test, all components or systems used in parallel for the same purpose (e.g., separate VVT actuators on the intake valves for Bank 1 and Bank 2, separate NOx converting catalysts on parallel exhaust banks) shall be simultaneously deteriorated to the malfunction criteria limit. Components or systems in series or used for different purposes (e.g., upstream and downstream exhaust gas sensors in a single exhaust bank, separate high pressure and low pressure EGR systems) may not be simultaneously deteriorated to the malfunction criteria limit.

(3.6) For each of the testing requirements under section (i)(3), if the manufacturer has established that only a functional check is required because no failure or deterioration of the specific tested system could result in an engine's emissions exceeding the emission threshold malfunction criteria (e.g., 1.5 times the standards), the manufacturer is not required to perform a demonstration test; however the manufacturer is required to provide the data and/or engineering analysis used to determine that only a functional test of the system(s) is required.

(4) Testing Protocol:

(4.1) Preconditioning:.The manufacturer may request Executive Officer approval to use a preconditioning cycle prior to conducting each of the above emission tests. The Executive Officer shall approve the request upon determining that a

manufacturer has provided data and/or engineering evaluation that demonstrate that the preconditioning is necessary to stabilize the emission control system. The manufacturer may also request Executive Officer approval to use an additional identical preconditioning cycle following a 20 minute hot soak after the initial preconditioning cycle. The Executive Officer shall approve the request upon determining that a manufacturer has provided data and/or engineering evaluation that demonstrate that the additional preconditioning is necessary to stabilize the emission control system. The manufacturer may not require the test engine to be cold soaked prior to conducting preconditioning cycles in order for the monitoring system testing to be successful. If a second preconditioning cycle is permitted, the manufacturer may adjust the system or component to be tested before conducting the second preconditioning cycle. The manufacturer may not replace, modify, or adjust the system or component after the last preconditioning cycle has taken place.

(4.2) Test Sequence:

(4.2.1) The manufacturer shall set the system or component on the test engine for which detection is to be tested at the malfunction criteria limit(s) prior to conducting the applicable emission test (or preconditioning, if approved).

(4.2.2) The test engine shall be operated over the first engine start of the FTP emission test (i.e., the cold start) or a SET cycle to allow for the initial detection of the tested system or component malfunction. If required by the designated monitoring strategy, an additional cold soak and first engine start of the FTP cycle (i.e., the cold start) may be performed prior to conducting this test cycle (e.g., for two-trip monitors that only run during cold starts).

(4.2.3) The test engine shall then be operated over the second engine start of the FTP emission test (i.e., the hot start) or an SET emission test. The second SET cycle may be omitted from the testing protocol if it is unnecessary (e.g., one-trip fault detection strategies that run on the SET).

(4.3) Test Data Collection:

(4.3.1) During the test sequence of section (i)(4.2), the manufacturer shall collect data immediately prior to each engine shut-down (e.g., the end of each preconditioning cycle in section (i)(4.2.1), the end of the cold start FTP cycle in section (i)(4.2.3), the end of the warm start FTP cycle in section (i)(4.2.3)). If the data cannot be collected immediately prior to engine shut-down, the data shall be collected immediately after engine shut-down.

(4.3.2) The manufacturer shall collect the following data:

(A) Approximate time on the test cycle (in seconds after engine start) when the MIL illuminates (e.g., MIL illuminated at 402 seconds into the cold start FTP cycle);

(B) All data required by sections (h)(4.1) through (h)(4.9) and (h)(5) including readiness status, current data stream values, fault code(s), freeze frame data, test results, CAL ID, CVN, VIN, ESN, ECU Name, in-use performance ratios, and engine run time tracking data.

(4.4) A manufacturer required to test more than one test engine (section (i)(2.2)) may utilize internal calibration sign-off test procedures (e.g., forced cool downs, less frequently calibrated emission analyzers) instead of official test procedures to obtain the emission test data required in section (i) for all but one of the required test engines. The manufacturer may elect this option if the data from the alternative test procedure are representative of official emission test results. Manufacturers using this option are still responsible for meeting the malfunction criteria specified in sections (e) through (g) when emission tests are performed in accordance with official test procedures.

(4.5) A manufacturer may request Executive Officer approval to utilize an alternate testing protocol for demonstration of MIL illumination if the engine dynamometer emission test cycle does not allow all of a monitor's enable conditions to be satisfied. A manufacturer may request the use of an alternate engine dynamometer test cycle or the use of chassis testing to demonstrate proper MIL illumination. In evaluating the manufacturer's request, the Executive Officer shall consider the technical necessity for using an alternate test cycle and the degree to which the alternate test cycle demonstrates that in-use operation with the malfunctioning component will properly result in MIL illumination.

(5) Evaluation Protocol:

(5.1) Full OBD engine ratings subject to sections (d)(7.1.1), (d)(7.2.2), or (d)(7.3) shall be evaluated according to the following protocol.

(5.1.1) For all tests conducted under section (i), the MIL shall be illuminated upon detection of the tested system or component malfunction before the end of the emission test specified in (i)(4.2.3) in accordance with the requirements of sections (e) through (g).

(5.1.2) If the MIL illuminates prior to emissions exceeding the applicable emission threshold malfunction criteria specified in sections (e) through (g), no further demonstration is required. With respect to the misfire monitor demonstration test, if a manufacturer has elected to use the minimum misfire malfunction criteria of one percent as allowed in sections (e)(2.2.2)(A) and (f)(2.2.2)(A), no further demonstration is required if the MIL illuminates with misfire implanted at the malfunction criteria limit.

(5.1.3) If the MIL does not illuminate when the system or component is set at its limit(s), the criteria limit or the OBD system is not acceptable.

(A) If the MIL first illuminates after emissions exceed the applicable emission threshold malfunction criteria specified in sections (e) through (g), the test engine shall be retested with the tested system or component adjusted so

that the MIL will illuminate without emissions exceeding the applicable emission threshold malfunction criteria specified in sections (e) through (g). If the system or component cannot be adjusted to meet this criterion because a default fuel or emission control strategy is used when a malfunction is detected (e.g., open loop fuel control used after an oxygen sensor malfunction is determined), the test engine shall be retested with the system or component adjusted to the worst acceptable limit (i.e., the applicable monitor indicates the system or component's performance is passing but at the closest possible value relative to the monitor threshold value at which a fault would be detected that would invoke the default strategy and illuminate the MIL). The manufacturer may request the Executive Officer to accept test data when the system or component's performance is at the worst acceptable limit within a margin of error necessary to accommodate testing variability and/or other practical limitations in setting the performance at the absolute worst acceptable limit. The Executive Officer shall accept the test data upon determining that the test data adequately demonstrate that emissions do not exceed the applicable malfunction criteria at the tested worst acceptable limit and that emissions will not exceed the applicable emission threshold malfunction criteria before performance exceeds the monitor threshold for fault detection. These provisions shall only apply to testing of the catalyst (i.e., components monitored under sections (e)(5.2.2), (e)(6.2.1), (e)(7.2.1), and (f)(6.2.1)) or PM filter system (i.e., (e)(8.2.1) and (e)(8.2.4)) if the on-board computer invokes a default fuel or emission control strategy upon detection of the relevant catalyst malfunction. Otherwise, the provisions of section (i)(5.1.3)(B) shall apply to testing of the catalyst or PM filter system.

(B) Except as provided for in section (i)(5.1.3)(A), in testing the catalyst (i.e., components monitored under sections (e)(5.2.2), (e)(6.2.1), (e)(7.2.1), and (f)(6.2.1)) or PM filter system (i.e., (e)(8.2.1) and (e)(8.2.4)), if the MIL first illuminates after emissions exceed the applicable emission threshold malfunction criteria specified in sections (e) and (f), the tested engine shall be retested with a less deteriorated catalyst/PM filter system (i.e., more of the applicable engine out pollutants are converted or trapped). Adjustment and testing of the catalyst or PM filter system's performance may be repeated until successful results are obtained. For the OBD system to be approved, either of the following conditions must be satisfied by the test results:

(i) The MIL is illuminated and emissions do not exceed the emission threshold malfunction criteria specified in sections (e) or (f); or

(ii) The manufacturer demonstrates that the MIL illuminates within the upper and lower limits of the malfunction criteria identified below. The demonstration shall be deemed appropriate when the test results show:

a. The MIL is illuminated and emissions exceed the emission threshold malfunction criteria specified in sections (e) or (f) by 20 percent or

less of the applicable standard (e.g., emissions are less than 2.2 times the applicable standard for an emission threshold malfunction criterion of 2.0 times the standard); and

b. The MIL is not illuminated and emissions are below the emission threshold malfunction criteria specified in sections (e) or (f) by no more than 20 percent of the standard (e.g., emissions are between 1.8 and 2.0 times the applicable standard for an emission threshold malfunction criterion of 2.0 times the standard).

(5.1.4) If an OBD system is determined unacceptable by the above criteria, the manufacturer may recalibrate and retest the system on the same test engine. In such a case, the manufacturer must confirm, by retesting, that all systems and components that were tested prior to recalibration and are affected by the recalibration function properly under the OBD system as recalibrated.

(5.2) OBD child ratings subject to sections (d)(7.1.2) or (d)(7.2.3) (i.e., extrapolated OBD) shall be evaluated according to the following protocol.

(5.2.1) For all tests conducted under section (i), the MIL shall be illuminated upon detection of the tested system or component malfunction before the end of the emission test specified in (i)(4.2.3) in accordance with the malfunction criteria established by the manufacturer under sections (d)(7.1.2) and (d)(7.2.3).

(5.2.2) Except for testing of the catalyst or PM filter system, if the MIL first illuminates after the tested component or system significantly exceeds the applicable malfunction criteria established by the manufacturer, the test engine shall be retested with the tested system or component adjusted so that the MIL will illuminate at the applicable malfunction criteria established by the manufacturer.

(5.2.3) In testing the catalyst or PM filter system, if the MIL first illuminates after the tested component or system significantly exceeds the applicable malfunction criteria established by the manufacturer, the tested engine shall be retested with a less deteriorated catalyst/PM filter system (i.e., more of the applicable engine out pollutants are converted or trapped). For the OBD system to be approved, testing shall be continued until either of the following conditions are satisfied:

(A) The MIL is illuminated and the tested component or system is at the applicable malfunction criteria established by the manufacturer; or

(B) The manufacturer demonstrates that the MIL illuminates within the upper and lower limits of the threshold identified below. The manufacturer shall demonstrate acceptable limits by continuing testing until the test results show:

(i) The MIL is illuminated and monitoring results indicate the tested

component or system exceeds the malfunction criteria established by the manufacturer by 10 percent or less of the monitored parameter; and

(ii) The MIL is not illuminated and monitoring results indicate the tested component or system is below the malfunction criteria established by the manufacturer by 10 percent or less of the monitored parameter.

(6) Confirmatory Testing:

(6.1) ARB may perform confirmatory testing to verify the emission test data submitted by the manufacturer under the requirements of section (i) comply with the requirements of section (i) and the malfunction criteria identified in sections (e) through (g). This confirmatory testing is limited to the engine rating represented by the demonstration engine(s).

(6.2) ARB or its designee may install appropriately deteriorated or malfunctioning components (or simulate a deteriorated or malfunctioning component) in an otherwise properly functioning test engine of an engine rating represented by the demonstration test engine(s) in order to test any of the components or systems required to be tested in section (i). Upon request by the Executive Officer, the manufacturer shall make available an engine and all test equipment (e.g., malfunction simulators, deteriorated components) necessary to duplicate the manufacturer's testing. The Executive Officer shall make the request within six months of reviewing and approving the demonstration test engine data submitted by the manufacturer for the specific engine rating.

(j) *Certification Documentation.*

(1) When submitting an application for certification of an engine, the manufacturer shall submit the following documentation. If any of the items listed below are standardized for all of a manufacturer's engines, the manufacturer may, for each model year, submit one set of documents covering the standardized items for all of its engines.

(1.1) For the required documentation not standardized across all engines, the manufacturer may propose to the Executive Officer that it be allowed to submit documentation for certification from one engine that is representative of other engines. The Executive Officer shall approve the engine as representative if the engine possesses the most stringent exhaust emission standards and OBD monitoring requirements and covers all of the emission control devices for the engines covered by the submitted documentation. Upon approval, this grouping shall be known as an "OBD certification documentation group".

(1.2) With Executive Officer approval, one or more of the documentation requirements of section (j) may be waived or modified if the information required would be redundant or unnecessarily burdensome to generate.

(1.3) To the extent possible, the certification documentation shall use SAE J1930 or J2403 terms, abbreviations, and acronyms.

(2) The following information shall be submitted as part of the certification application. Except as provided below for demonstration data, the Executive Officer will not issue an Executive Order certifying the covered engines without the information having been provided. The information must include:

(2.1) A description of the functional operation of the OBD system including a complete written description for each monitoring strategy that outlines every step in the decision-making process of the monitor. Algorithms, diagrams, samples of data, and/or other graphical representations of the monitoring strategy shall be included where necessary to adequately describe the information.

(2.2) A table, in the standardized format detailed in Attachment C of ARB Mail-Out #MSC 09-22.

(2.2.1) The table must include the following information for each monitored component or system (either computer-sensed or -controlled) of the emission control system:

(A) Corresponding fault code

(B) Monitoring method or procedure for malfunction detection

(C) Primary malfunction detection parameter and its type of output signal

(D) Fault criteria limits used to evaluate output signal of primary parameter

(E) Other monitored secondary parameters and conditions (in engineering units) necessary for malfunction detection

(F) Monitoring time length and frequency of checks

(G) Criteria for storing fault code

(H) Criteria for illuminating malfunction indicator light

(I) Criteria used for determining out-of-range values and input component rationality checks

(2.2.2) Wherever possible, the table shall use the following engineering units:

(A) Degrees Celsius (°C) for all temperature criteria

(B) KiloPascals (KPa) for all pressure criteria related to manifold or atmospheric pressure

(C) Grams (g) for all intake air mass criteria

(D) Pascals (Pa) for all pressure criteria related to evaporative system vapor pressure

(E) Miles per hour (mph) for all vehicle speed criteria

(F) Relative percent (%) for all relative throttle position criteria (as defined in SAE J1979/J1939)

(G) Voltage (V) for all absolute throttle position criteria (as defined in SAE J1979/J1939)

(H) Milligrams per stroke (mg/stroke) for all fuel quantity-based per ignition event criteria for diesel engines, and per crankshaft revolution (/rev) for all other changes per ignition event based criteria (e.g., airflow in g/rev instead of g/stroke or g/firing) for gasoline and diesel engines

(I) Per second (/sec) for all changes per time based criteria (e.g., g/sec)

(J) Percent of nominal tank volume (%) for all fuel tank level criteria

(2.3) A logic flowchart describing the step-by-step evaluation of the enable criteria and malfunction criteria for each monitored emission-related component or system.

(2.4) Emission test data, a description of the testing sequence (e.g., the number and types of preconditioning cycles), the data required to be collected in section (i)(4.3), and a description of the modified or deteriorated components used for fault simulation with respect to the demonstration tests specified in section (i). The Executive Officer may approve conditional certification of an engine prior to the submittal of this data for ARB review and approval. Factors to be considered by the Executive Officer in approving the late submission of information identified in section (j)(2.4) shall include the reason for the delay in the data collection, the length of time until data will be available, and the demonstrated previous success of the manufacturer in submitting the data prior to certification.

(2.5) For gasoline engines, data supporting the misfire monitor, including:

(2.5.1) The established percentage of misfire that can be tolerated without damaging the catalyst over the full range of engine speed and load conditions.

(2.5.2) Data demonstrating the probability of detection of misfire events of the misfire monitoring system over the full engine speed and load operating range as detailed in ARB Mail-Out #MSC 09-22 for the following misfire patterns: random cylinders misfiring at the malfunction criteria established in section (f)(2.2.2), one cylinder continuously misfiring, and paired cylinders continuously misfiring.

(2.5.3) Data identifying all disablement of misfire monitoring that occurs during the FTP. For every disablement that occurs during the cycles, the data shall identify: when the disablement occurred relative to the driver's trace, the number of engine revolutions that each disablement was present for, and which disable condition documented in the certification application caused the disablement. The number of 1000-revolution intervals completed and the number of 1000-revoluation intervals in which the FTP misfire threshold

was exceeded shall also be identified. The data shall be submitted in the standardized format detailed in Attachment A: Misfire Disablement and Detection Chart of ARB Mail-Out #MSC 09-22.

(2.5.4) Manufacturers are not required to use the durability demonstration engine to collect the misfire data for sections (j)(2.5.1) through (2.5.3).

(2.6) For diesel engines subject to the monitoring requirements of section (e)(2.2.2), data supporting the misfire monitor, including:

(2.6.1) Data demonstrating the probability of detection of misfire events of the misfire monitoring system as detailed in ARB Mail-Out #MSC 09-22 over the required engine speed and load operating range for the following misfire patterns: random cylinders misfiring at the malfunction criteria specified in section (e)(2.2.2), one cylinder continuously misfiring, and paired cylinders continuously misfiring.

(2.6.2) Data identifying all disablement of misfire monitoring that occurs during the EPA Urban Dynamometer Driving Schedule for Heavy-Duty Vehicles specified in 40 CFR Part 86, Appendix I (d). For every disablement that occurs during the cycle, the data shall identify: when the disablement occurred relative to the driver's trace, the number of engine revolutions that each disablement was present for, and which disable condition documented in the certification application caused the disablement. The number of 1000-revolution intervals completed and the number of 1000-revoluation intervals in which the misfire threshold was exceeded shall also be identified. The data shall be submitted in the standardized format detailed in Attachment A: Misfire Disablement and Detection Chart of ARB Mail-Out #MSC 09-22.

(2.7) Data supporting the criteria used to detect a malfunction of the fuel system, EGR system, boost pressure control system, catalyst, NOx adsorber, PM filter, cold start emission reduction strategy, secondary air, evaporative system, VVT system, exhaust gas sensors, and other emission controls which causes emissions to exceed the applicable malfunction criteria specified in sections (e), (f), and (g). For diesel engine monitors in sections (e) and (g) that are required to indicate a malfunction before emissions exceed an emission threshold based on any applicable standard (e.g., 1.5 times any of the applicable standards), the test cycle and standard determined by the manufacturer to be the most stringent for each applicable monitor in accordance with section (d)(6.1) and the adjustment factors determined by the manufacturer for each applicable monitor in accordance with section (d)(6.2).

(2.8) A listing of all electronic powertrain input and output signals (including those not monitored by the OBD system) that identifies which signals are monitored by the OBD system. For input and output signals that are monitored as comprehensive components, the listing shall also identify the specific fault code for each malfunction criteria (e.g., out of range low, out of range high, open circuit, rationality low, rationality high).

(2.9) A written description of all parameters and conditions necessary to begin closed-loop/feedback control of emission control systems (e.g., fuel system, boost pressure, EGR flow, SCR reductant delivery, PM filter regeneration, fuel system pressure).

(2.10) A written identification of the communication protocol utilized by each engine for communication with an SAE J1978/J1939 scan tool.

(2.11) A pictorial representation or written description of the diagnostic connector and its location including any covers or labels.

(2.12) A written description of the method used by the manufacturer to meet the requirements of section (g)(2) for CV system monitoring including diagrams or pictures of valve and/or hose connections.

(2.13) A written description of each AECD utilized by the manufacturer including the sensor signals and/or calculated values used to invoke each AECD, the engineering data and/or analysis demonstrating the need for such an AECD, the actions taken when each AECD is activated, the expected in-use frequency of operation of each AECD, the expected emission impact from each AECD activation, the expected emission impact from each AECD activation, and, for diesel engines, the identification of each AECD that has been determined by the manufacturer to be an EI-AECD and the assignment by the manufacturer to the data required to be tracked and reported in the standardized format specified in section (h)(6) (e.g., the AECD of "engine overheat protection as determined by coolant temperature greater than..." is an EI-AECD and is reported as EI-AECD #1 to a generic scan tool).

(2.14) A written description of each NOx and PM NTE deficiency and emission carve-out utilized by the manufacturer including the sensor signals and/or calculated values used to invoke each NTE deficiency or carve-out, the engineering data and/or analysis demonstrating the need for such an NTE deficiency or carve-out, the actions taken when each NTE deficiency or carve-out is activated, the expected in-use frequency of operation of each NTE deficiency or carve-out, and the expected emission impact from each NTE deficiency or carve-out activation.

(2.15) Build specifications provided to engine purchasers or chassis manufacturers detailing all specifications or limitations imposed on the engine purchaser relevant to OBD requirements or emission compliance (e.g., allowable MIL locations, connector location specifications, cooling system heat rejection rates). A description of the method or copies of agreements used to ensure engine purchasers or chassis manufacturers will comply with the OBD and emission relevant build specifications (e.g., signed agreements, required audit/evaluation procedures).

(2.16) A cover letter identifying all concerns and deficiencies applicable to the equivalent previous model year engine, the changes and/or resolution of each concern or deficiency for the current model year engine, and all other known

issues that apply to the current model year engine (e.g., concerns or deficiencies of another engine that also apply to this engine).

(2.17) A checklist of all the malfunction criteria in sections (e), (f), and (g) and the corresponding diagnostic noted by fault code for each malfunction criterion. The formats of the checklists are detailed in Attachments G and H of ARB Mail-Out #MSC 09-22, July 7, 2009, incorporated by reference.

(2.18) A list of all components/systems required to track and report in-use performance under section (d)(3.2.1), the corresponding diagnostic(s) noted by fault code used to increment the numerator for each component/system, and a description of the incrementing specifications for the in-use monitor performance numerator and denominator for each diagnostic.

(2.19) A list of the test results required to be made available under section (h)(4.5) and the corresponding diagnostic(s) noted by fault code for each test result.

(2.20) A timeline showing the start of engine production and the start of vehicle production for the engine family, and the required deadlines for production vehicle evaluation testing of the standardized requirements (according to section (l)(1.2)) and the monitoring requirements (according to section (l)(2.1)).

(2.21) Any other information determined by the Executive Officer to be necessary to demonstrate compliance with the requirements of this regulation.

(k) *Deficiencies.*

(1) The Executive Officer, upon receipt of an application from the manufacturer, may certify OBD systems installed on engines even though the systems do not comply with one or more of the requirements of title 13, CCR section 1971.1.1. In granting the certification, the Executive Officer shall consider the following factors: the extent to which the requirements of section 1971.1.1 are satisfied overall based on a review of the engine applications in question, the relative performance of the resultant OBD system compared to systems fully compliant with the requirements of section 1971.1.1, and a demonstrated good-faith effort on the part of the manufacturer to: (1) meet the requirements in full by evaluating and considering the best available monitoring technology; and (2) come into compliance as expeditiously as possible. The Executive Officer may not grant certification to an engine in which the reported noncompliance for which a deficiency is sought would be subject to ordered recall pursuant to section 1971.5.1(d)(3)(A).

(2) For 2013 and subsequent model year engines, manufacturers of OBD systems for which deficiencies have been granted are subject to fines pursuant to section 43016 of the California Health and Safety Code. The specified fines apply to: (1) the third and subsequently identified deficiency(ies), ordered according to section (k)(3), and (2) a monitoring system deficiency where a required monitoring strategy is completely absent from the OBD system.

(3) The fines for engines specified in section (k)(2) above are in the amount of $50 per deficiency per engine for non-compliance with any of the monitoring requirements specified in sections (e), (f), and (g)(4), and $25 per deficiency per engine for non-compliance with any other requirement of section 1971.1.1. In determining the identified order of deficiencies, deficiencies subject to a $50 fine are identified first. Total fines per engine under section (k) may not exceed $500 per engine and are payable to the State Treasurer for deposit in the Air Pollution Control Fund.

(4) Manufacturers must re-apply for Executive Officer approval of a deficiency each model year. In considering the request to carry-over a deficiency, the Executive Officer shall consider the factors identified in section (k)(1) including the manufacturer's progress towards correcting the deficiency. Except as provided for in sections (k)(4.1) and (k)(4.2) below, the Executive Officer may not allow manufacturers to carry over monitoring system deficiencies for more than two model years unless it can be demonstrated that substantial engine hardware modifications and additional lead time beyond two years would be necessary to correct the deficiency, in which case the Executive Officer shall allow the deficiency to be carried over for three model years.

(4.1) For deficiencies first granted in the 2010 model year, the Executive Officer may allow manufacturers to carry over the deficiency into the 2013 model year unless it can be demonstrated that substantial engine hardware modifications and additional lead time beyond the 2013 model year would be necessary to correct the deficiency, in which case the Executive Officer shall allow the deficiency to be carried over into the 2014 model year.

(4.2) For deficiencies first granted in the 2011 model year, the Executive Officer may allow manufacturers to carry over the deficiency into the 2014 model year.

(5) Except as allowed in section (k)(6), deficiencies may not be retroactively granted after certification.

(6) Request for retroactive deficiencies

(6.1) During either the first 6 months after commencement of the start of engine production or the first 6 months after commencement of the start of vehicle production, whichever is later, manufacturers may request that the Executive Officer grant a deficiency and amend an engine's certification to conform to the granting of the deficiencies for each aspect of the monitoring system: (a) identified by the manufacturer (during testing required by section (l)(2) or any other testing) to be functioning different than the certified system or otherwise not meeting the requirements of any aspect of section 1971.1.1; and (b) reported to the Executive Officer. If the Executive Officer grants the deficiency(ies) and amends the certification, the approval would be retroactive to all affected engines within the engine family.

(6.2) Executive Officer approval of the request for a retroactive deficiency shall be granted provided that the conditions necessary for a pre-certification deficiency

determination are satisfied (see section (k)(1)) and the manufacturer could not have reasonably anticipated the identified problem before commencement of production.

(6.3) In granting the amended certification, the Executive Officer shall include any approved post-production deficiencies together with all previously approved deficiencies in computing fines in accordance with section (k)(2).

(7) For 2013 through 2015 model year engines that utilize PM sensors for PM filter filtering performance monitoring (section (e)(8.2.1)), in cases where the deficiency is for a monitor required to detect malfunctions of the PM filter filtering performance (section (e)(8.2.1)), the PM sensor (section (e)(9.2.2)), or the PM sensor heater (section (e)(9.2.4)), the deficiency shall be exempt from the specified fines of section (k)(3) and the deficiency shall not be included in the count of deficiencies used in (k)(2) to determine the number of deficiencies subject to fines.

(8) For hybrid vehicles:

(8.1) For 2014 model year hybrid vehicles previously certified with deficiencies for the 2013 model year, the 2014 model year shall be considered the first model year for the deficiency with regards to the carry-over provisions in section (k)(4).

(8.2) For deficiencies related to issues with the implementation of the hybrid system or of the hybrid system itself on 2013 through 2015 model year engines, two additional deficiencies shall be exempt from the specified fines of section (k)(3) and the deficiencies shall not be included in the count of deficiencies used in (k)(2) to determine the number of deficiencies subject to fines.

(9) Any OBD system installed on a production engine/vehicle that fails to conform with the certified OBD system for that engine/vehicle or otherwise fails to meet the requirements of section 1971.1.1 and has not been granted a deficiency pursuant to the provisions of section (k)(1) through (k)(6) are considered non-compliant. The engines/vehicles are subject to enforcement pursuant to applicable provisions of the Health and Safety Code and title 13, CCR section 1971.5.1.

(l) *Production Engine/Vehicle Evaluation Testing.*

(1) Verification of Standardized Requirements.

(1.1) Requirement: Manufacturers shall perform testing to verify that 2013 and subsequent model year production engines installed in vehicles meet the requirements of section (h)(3) and (h)(4) relevant to proper communication of required emission-related messages to an SAE J1978/J1939 scan tool.

(1.2) Selection of Test Vehicles:

(1.2.1) Engine manufacturers shall perform this testing every model year on ten unique production vehicles (i.e., engine rating and chassis application combination) per engine family. If there are less than ten unique

production vehicles for a certain engine family, the manufacturer shall test each unique production vehicle in that engine family. Manufacturers shall perform this testing no later than either three months after the start of engine production or one month after the start of vehicle production, whichever is later. Manufacturers may request Executive Officer approval to group multiple production vehicles together and test one representative vehicle per group. The Executive Officer shall approve the request upon finding that the software and hardware designed to comply with the standardization requirements of section (h) (e.g., communication protocol message timing, number of supported data stream parameters, engine and vehicle communication network architecture) in the representative vehicle are identical to all others in the group and that any differences in the production vehicles are not relevant with respect to meeting the criteria in section (l)(1.4).

(1.2.2) For 2016 and subsequent model year engines, the Executive Officer shall reduce the maximum required number of vehicles to be tested from ten per engine family to five per engine family for a manufacturer based on the demonstrated previous success of the manufacturer to meet the requirements of section (l)(1). For purposes of this requirement, a manufacturer shall be determined to be successful in meeting the requirements of section (l)(1) if zero vehicles fail the testing required by section (l)(1) for two consecutive years.

(1.2.3) For 2019 and subsequent model year engines, the Executive Officer shall further reduce the maximum required number of vehicles to be tested to three per engine family for a manufacturer based on the demonstrated previous success of the manufacturer to meet the requirements of section (l)(1). For purposes of this requirement, a manufacturer shall be determined to be successful in meeting the requirements of section (l)(1) if zero vehicles fail the testing required by section (l)(1) for three consecutive years.

(1.2.4) The Executive Officer may waive the requirement for submittal of data from one or more of the production vehicles if data have been previously submitted for all of the production vehicles. Manufacturers may request Executive Officer approval to carry over data collected in previous model years. The Executive Officer shall approve the request upon finding that the software and hardware designed to comply with the standardization requirements of section (h) are identical to the previous model year and no other hardware or software changes that affect compliance with the standardization requirements have been made.

(1.3) Test Equipment: For the testing required in section (l)(1), manufacturers shall utilize an off-board device to conduct the testing. Prior to conducting testing, manufacturers are required to request and receive Executive Officer approval of the off-board device that the manufacturer will use to perform the testing.

(1.3.1) For vehicles using the ISO 15765-4 protocol for the standardized functions required in section (h), the Executive Officer shall approve the request upon determining that the manufacturer has submitted data, specifications, and/or engineering analysis that demonstrate that the off-board device meets the minimum requirements to conduct testing according to SAE J1699-3 using the software developed and maintained for the SAE J1699-3 committee and available through www.sourceforge.net and SAE J2534 compliant hardware configured specifically for SAE J1699-3 testing.

(1.3.2) For vehicles using the SAE J1939 protocol for the standardized functions required in section (h), the Executive Officer shall approve the request upon determining that the manufacturer has submitted data, specifications, and/or engineering analysis that demonstrate that the off-board device is able to verify that vehicles tested are able to perform all of the required functions in section (l)(1.4) with any other off-board device designed and built in accordance with the SAE J1978/J1939 generic scan tool specifications.

(1.4) Required Testing:

(1.4.1) The testing shall verify that communication can be properly established between all emission-related on-board computers and any SAE J1978/J1939 scan tool designed to adhere strictly to the communication protocols allowed in section (h)(3);

(1.4.2) The testing shall verify that all emission-related information is properly communicated between all emission-related on-board computers and any SAE J1978/J1939 scan tool in accordance with the requirements of section (h) and the applicable ISO and SAE specifications including specifications for physical layer, network layer, message structure, and message content.

(1.4.3) The testing shall further verify that the following information can be properly communicated to any SAE J1978/J1939 scan tool:

(A) The current readiness status from all on-board computers required to support readiness status in accordance with SAE J1979/J1939-73 and section (h)(4.1) in the key on, engine off position and while the engine is running;

(B) The MIL command status while the MIL is commanded off and while the MIL is commanded on in accordance with SAE J1979/J1939 and section (h)(4.2) in the key on, engine off position and while the engine is running, and in accordance with SAE J1979/J1939 and sections (d)(2.1.2) during the MIL functional check and, if applicable, (h)(4.1.3) during the MIL readiness status check while the engine is off;

(C) All data stream parameters required in section (h)(4.2) in accordance with SAE J1979/J1939 including, if applicable, the proper identification of each data stream parameter as supported in SAE J1979 (e.g., Mode/Service $01, PID $00);

(D) The CAL ID, CVN, ESN, and VIN in accordance with SAE J1979/J1939 and sections (h)(4.6) through (4.8);

(E) An emission-related fault code (permanent, confirmed, pending, MIL-on, and previously MIL-on) in accordance with SAE J1979/J1939-73 (including correctly indicating the number of stored fault codes and MIL command status (e.g., Mode/Service $01, PID $01, Data A for SAE J1979)) and section (h)(4.4) for each diagnostic and emission critical electronic powertrain control unit;

(1.4.4) The testing shall also verify that the on-board computer(s) can properly respond to any SAE J1978/J1939 scan tool request to clear emission-related fault codes and reset readiness status in accordance with section (h)(4.10).

(1.5) Reporting of Results:

(1.5.1) The manufacturer shall submit to the Executive Officer the following, based on the results of testing:

(A) If a variant meets all the requirements of section (l)(1.4), the test results (i.e., the test log file) and a statement specifying that the variant passed all the tests, or

(B) If any variant does not meet the requirements of section (l)(1.4), a written report to the Executive Officer for approval within one month of testing the specific variant. The written report shall include the problem(s) identified and the manufacturer's proposed corrective action (if any) to remedy the problem(s). Factors to be considered by the Executive Officer in approving the proposed corrective action shall include the severity of the problem(s), the ability of the vehicle to be tested in a California inspection program (e.g., roadside inspection, fleet self-inspection program), the ability of service technicians to access the required diagnostic information, the impact on equipment and tool manufacturers, and the amount of time prior to implementation of the proposed corrective action.

(1.5.2) Upon request of the Executive Officer, a manufacturer shall submit a report of the results of any testing conducted pursuant to section (l)(1) to the Executive Officer for review.

(1.5.3) In accordance with section (k)(6), manufacturers may request Executive Officer approval for a retroactive deficiency to be granted for items identified during this testing.

(1.6) Alternative Testing Protocols. Manufacturers may request Executive Officer approval to use other testing protocols. The Executive Officer shall approve the protocol if the manufacturer can demonstrate that the alternate testing methods and equipment provide an equivalent level of verification of compliance with the standardized requirements to the requirements of section (l)(1).

(2) Verification of Monitoring Requirements.

(2.1) No later than either six months after the start of engine production or three months after the start of vehicle production, whichever is later, manufacturers shall conduct a complete evaluation of the OBD system of one or more production vehicles (test vehicles) and submit the results of the evaluation to the Executive Officer.

(2.2) Selection of test vehicles:

(2.2.1) For each engine selected for monitoring system demonstration in section (j), the manufacturer shall evaluate one production vehicle equipped with an engine from the same engine family and rating as the demonstration engine. The Executive Officer shall select the specific production vehicle(s) to be tested.

(2.2.2) A manufacturer required to test more than one test vehicle may test an engine in lieu of a vehicle for all but one of the required test vehicles.

(2.2.3) The Executive Officer may waive the requirements for submittal of evaluation results from one or more of the test vehicles if data have been previously submitted for all of the engine ratings and variants.

(2.3) Evaluation requirements:

(2.3.1) The evaluation shall demonstrate the ability of the OBD system on the selected production vehicle to detect a malfunction, illuminate the MIL, and, where applicable, store an appropriate fault code readable by a scan tool conforming to SAE J1978/J1939 when a malfunction is present and the monitoring conditions have been satisfied for each individual diagnostic required by title 13, CCR section 1971.1.1.

(2.3.2) The evaluation shall verify that malfunctions detected by non-MIL illuminating diagnostics of components used to enable any other OBD system diagnostic (e.g., fuel level sensor) will not inhibit the ability of other OBD system diagnostics to properly detect malfunctions.

(2.3.3) The evaluation shall verify that the software used to track the numerator and denominator for purposes of determining in-use monitoring frequency correctly increments as required in section (d)(4).

(2.3.4) Malfunctions may be mechanically implanted or electronically simulated but internal on-board computer hardware or software changes may not be used to simulate malfunctions. For monitors that are required to indicate a malfunction before emissions exceed an emission threshold based on any applicable standard (e.g., 2.0 times any of the applicable standards), manufacturers are not required to use malfunctioning components/systems set exactly at their malfunction criteria limits. Emission testing to confirm that the malfunction is detected before the appropriate emission threshold malfunction criteria (e.g., 2.0 times the standard) are exceeded is not required.

(2.3.5) Manufacturers shall submit a proposed test plan for Executive Officer approval prior to evaluation testing being performed. The test plan shall identify the method used to induce a malfunction for each diagnostic. If the Executive Officer determines that the requirements of section (l)(2) are satisfied, the proposed test plan shall be approved.

(2.3.6) Subject to Executive Officer approval, manufacturers may omit demonstration of specific diagnostics. The Executive Officer shall approve a manufacturer's request if the demonstration cannot be reasonably performed without causing physical damage to the vehicle (e.g., on-board computer internal circuit faults) or jeopardizing the safety of personnel performing the demonstration.

(2.3.7) For evaluation of test vehicles selected in accordance with section (l)(2.2), manufacturers are not required to demonstrate diagnostics that were previously demonstrated prior to certification as required in section (i).

(2.4) Manufacturers shall submit a report of the results of all testing conducted pursuant to section (l)(2) to the Executive Officer for review. This report shall identify the method used to induce a malfunction in each diagnostic, the MIL illumination status, and the fault code(s) stored.

(2.5) In accordance with section (k)(6), manufacturers may request Executive Officer approval for a retroactive deficiency to be granted for items identified during this testing.

(3) Verification and Reporting of In-use Monitoring Performance.

(3.1) Manufacturers are required to collect and report in-use monitoring performance data representative of production vehicles (i.e., engine rating and chassis application combination). Manufacturers shall collect and report the data to ARB within twelve months after the production vehicles were first introduced into commerce.

(3.2) Manufacturers shall separate production vehicles into monitoring performance groups, as defined by sections (l)(3.2.1) and (3.2.2) below, and submit data representative of each group:

(3.2.1) Emission architecture. Engines shall be separated by emission architecture. All engines that use the same or similar emission control architecture and monitoring system shall be in the same emission architecture category.

(3.2.2) Monitoring performance group. Within an emission architecture category, engines shall be separated by vehicle application. The separate monitoring performance groups shall be based on three classifications: engines intended primarily for line-haul chassis applications, engines intended primarily for urban delivery chassis applications, and all other engines.

(3.3) Manufacturers may request Executive Officer approval to use an alternate grouping method to collect representative data. Executive Officer approval shall be granted upon determining that the proposed groupings include production vehicles using similar emission controls, OBD strategies, monitoring condition calibrations, and vehicle application driving/usage patterns such that they are expected to have similar in-use monitoring performance. If approved by the Executive Officer, the manufacturer may submit one set of data for each of the approved groupings.

(3.4) For each group, the data must include all of the in-use performance tracking data reported through SAE J1979/J1939 (i.e., all numerators, denominators, the general denominator, and the ignition cycle counter), the engine model year, the engine manufacturer, the engine family, the engine serial number, the engine HP rating (for diesels), the engine torque rating (for diesels), the date the data were collected, the odometer reading, the vehicle/chassis VIN, the monitoring performance group, and the ECM software calibration identification number and be in the standardized format detailed in Attachments D and E of ARB Mail-Out #MSC 09-22.

(3.5) Manufacturers shall submit a plan to the Executive Officer for review and approval that details the types of production vehicles in each group, the number of vehicles per group to be sampled, the sampling method, the time line to collect the data, and the reporting format. The Executive Officer shall approve the plan upon determining that it provides for effective collection of data from a sample of vehicles that, at a minimum, is fifteen vehicles per group, will likely result in the collection and submittal of data within the required time frame, will generate data that are representative of California drivers and temperatures, and does not, by design, exclude or include specific vehicles in an attempt to collect data only from vehicles with the highest in-use performance ratios.

(3.6) Upon request of the manufacturer, the Executive Officer may for good cause extend the twelve month time requirement set forth in section (l)(3.1) up to a maximum of eighteen months. In granting additional time, the Executive Officer shall consider, among other things, information submitted by the manufacturer to justify the delay, sales volume of the group(s), and the sampling mechanism utilized by the manufacturer to procure vehicles for data collection. If an extension beyond twelve months is granted, the manufacturer shall additionally be required to submit an interim report within twelve months for data collected up to the time of the interim report.

(4) Verification of In-Use Compliance

(4.1) As a condition for certification, manufacturers are required to perform compliance testing on in-use engines as specified in California Code of Regulations, title 13, section 1971.5.1(c).

NOTE: Authority cited: Sections 39010, 39600, 39601, 43000.5, 43013, 43016, 43018, 43100, 43101, 43104, 43105, 43105.5, 43106, 43154, 43211, and 43212, Health and

Safety Code. Reference: Sections 39002, 39003, 39010, 39018, 39021.5, 39024, 39024.5, 39027, 39027.3, 39028, 39029, 39031, 39032, 39032.5, 39033, 39035, 39037.05, 39037.5, 39038, 39039, 39040, 39042, 39042.5, 39046, 39047, 39053, 39054, 39058, 39059, 39060, 39515, 39600, 39601, 43000, 43000.5, 43004, 43006, 43013, 43016, 43018, 43100, 43101, 43102, 43104, 43105, 43105.5, 43106, 43150, 43151, 43152, 43153, 43154, 43155, 43156, 43204, 43211, and 43212, Health and Safety Code.

§ 1971.5.1. Enforcement of Malfunction and Diagnostic System Requirements for 2010 and Subsequent Model-Year Heavy-Duty Engines. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) *General.*

(1) *Applicability.*

(A) These procedures shall be used to assure compliance with the requirements of California Code of Regulations (Cal. Code Regs.), title 13, section 1971.1.1 for all 2010 and subsequent model year heavy-duty engines equipped with OBD systems that have been certified for sale in California.

(B) Engines manufactured prior to the 2010 model year are covered by the general enforcement and penalty provisions of the Health and Safety Code, and the specific provisions of Cal. Code Regs., title 13, section 1971 and section 2111 through section 2149.

(2) *Purpose.*

The purpose of this section is to establish the enforcement protocol that shall be used by the Air Resources Board (ARB) to assure that engines certified for sale in California are equipped with OBD systems that properly function and meet the purposes and requirements of Cal. Code Regs., title 13, section 1971.1.1.

(3) *Definitions.*

The definitions applicable to these rules include those set forth in Health and Safety Code section 39010 et seq. and in Cal. Code Regs., title 13, section 1900(b) and section 1971.1.1(c), which are incorporated by reference herein. The following definitions are specifically applicable to section 1971.5.1 and take precedence over any contrary definitions.

"*Days*", when computing any period of time, unless otherwise noted, means normal working days that a manufacturer is open for business.

"*Engine Class*" means a group or set of engines subject to enforcement testing that have been determined by the Executive Officer to share common or similar hardware, software, OBD monitoring strategy, or emission control strategy.

"*Engine Manufacturer*" means the manufacturer granted certification to sell engines in the State of California.

"*Executive Officer*" means the Executive Officer of ARB or his or her authorized representative.

"*Influenced OBD-Related Recall*" means an inspection, repair, adjustment, or modification program initiated and conducted by a manufacturer as a result of

enforcement testing conducted by the ARB or any other information for the purpose of correcting any nonconforming OBD system for which direct notification of vehicle or engine owners is necessary.

"*Major Monitor*" means those monitors covered by the requirements set forth in Cal. Code Regs., title 13, section 1971.1.1(e), (f), and (g)(4).

"*Nonconforming OBD System*" means an OBD system on a production engine that has been determined not to comply with the emission standards as defined in Cal. Code Regs., title 13, section 1971.1.1(c), irrespective of whether engines in the engine class, on average, meet other applicable emission standards (e.g., exhaust emission standards defined in Cal. Code Regs., title 13, section 1956.8, evaporative emission standards defined in Cal. Code Regs., title 13, section 1976).

"*OBD Emission Testing*" refers to testing conducted to determine compliance with the malfunction criteria in Cal. Code Regs., title 13, section 1971.1.1(e) through (g) that are based on a multiple of, or an additive to, a tailpipe emission standard or an absolute measurement from an applicable emission test cycle (e.g., 1.5 times the applicable federal test procedure (FTP) emission standards, PM standard plus 0.02 g/bhp-hr, PM level of 0.03 g/bhp-hr as measured from an applicable emission test cycle).

"*OBD Ratio Testing*" refers to testing conducted to determine compliance with the required in-use monitor performance ratio in Cal. Code Regs., title 13, section 1971.1.1(d)(3.2.2).

"*Ordered OBD-Related Recall*" means an inspection, repair, adjustment, or modification program required by ARB to be conducted by the manufacturer to correct any nonconforming OBD system for which direct notification of vehicle or engine owners is necessary.

"*Quarterly Reports*" refer to the following calendar periods: January 1 – March 31; April 1 – June 30; July 1 – September 30; October 1 – December 31.

"*Test Sample Group*" means a group of production engines in a designated engine class that are equipped with OBD systems and are selected and tested as part of the enforcement testing program set forth in sections (b) and (c).

"*Voluntary OBD-Related Recall*" means an inspection, repair, adjustment, or modification program voluntarily initiated and conducted by a manufacturer to correct any nonconforming OBD system for which direct notification of vehicle or engine owners is necessary.

(b) *Testing Procedures for ARB-Conducted Testing.*

(1) *Purpose.*

To assure that OBD systems on production engines comply with the requirements of Cal. Code Regs., title 13, section 1971.1.1, ARB may periodically evaluate engines from an engine class.

(2) *Preliminary Testing and Evaluation.*

(A) As part of his or her evaluation of engines to determine compliance with the requirements of Cal. Code Regs., title 13, section 1971.1.1, the Executive Officer may routinely conduct testing on any production engines that have been certified for sale in California.

(B) Based upon such testing or any other information, including data from California or other state heavy duty inspection programs, warranty information reports, and field information reports, the Executive Officer may conduct enforcement testing pursuant to sections (b)(3) through (5) below.

(3) *Engine Selection for ARB-Conducted Enforcement Testing.*

(A) Determining the Engine Class.

(i) Upon deciding to conduct enforcement testing, the Executive Officer shall determine the engine class to be tested. In determining the scope of the engine class to be tested, the Executive Officer shall consider the similarities and differences in the OBD systems of potentially affected engines. Among other things, the Executive Officer shall consider whether engines share similar computer hardware and software, calibrations, or OBD monitoring and emission control strategies.

(ii) The default engine class is the engine family or OBD group used by the manufacturer to certify the engines to be tested. However, upon concluding that a subgroup of engines differs from other engines in the identified engine family or OBD group and that a reasonable basis exists to believe that the differences may directly impact the type of testing that will be performed, the Executive Officer may determine that a subgroup of the engine family or OBD group is the appropriate engine class for testing.

(iii) Similarly, upon concluding that engines from several engine families or OBD groups (which may include engine families or OBD groups from different model years) share such common characteristics that a reasonable basis exists to believe that results of enforcement testing may be applicable to an engine class larger than a specific engine family or OBD group, the Executive Officer may determine that the appropriate engine class includes more than one engine family or OBD group.

(iv) Except for testing to determine if an OBD system has been designed to deactivate based on age and/or mileage (Cal. Code Regs., title 13, section 1971.1.1(d)(1.3)), the Executive Officer may not conduct testing of an engine class whose engines, on average, exceed the defined full useful life of the engine class. For purposes of the determination of this average, the Executive Officer shall use the accrual rates appropriate for engines in the engine class considering the vehicle weight class, usage type, and other subcategories as defined and used by EMFAC2007, which is incorporated by reference herein.

(B) Size of Test Sample Group.

After determining the engine class to be tested, the Executive Officer shall determine the appropriate number of engines to include in the test sample group for enforcement testing in accordance with the following guidelines:

(i) For OBD emission testing, the Executive Officer shall follow the provisions of Cal. Code Regs., title 13, section 2137 regarding test sample size. In accordance with section 2137, the Executive Officer shall test 10 engines that have been procured following the protocol of section (b)(3)(C) below and meet the selection criteria of section (b)(3)(D)(i) below to determine the emissions characteristics of the engine class being tested.

(ii) For OBD ratio testing, the Executive Officer shall collect data from a test sample group of 30 engines that have been procured following the protocol of section (b)(3)(C) below and meet the selection criteria of section (b)(3)(D)(ii) below to determine the in-use OBD monitoring performance of the engine class being tested.

(iii) In determining compliance with any other requirements of Cal. Code Regs., title 13, section 1971.1.1 (e.g., diagnostic connector location, communication protocol standards, MIL illumination protocol, evaporative system diagnostics, etc.), the Executive Officer shall determine, on a case by case basis, the number of engines meeting the selection criteria of section (b)(3)(D)(iii) needed to assure that the results of such testing may be reasonably inferred to the engine class. The Executive Officer's determination shall be based upon the nature of the nonconformance and the scope of the engine class. The test sample group could be as few as two test engines.

(C) Protocol for Procuring Engines for Test Sample Group.

(i) For OBD emission and ratio testing, the Executive Officer shall determine the appropriate manner for procuring engines. In making his or her determination, the Executive Officer shall consider the nature of the nonconformance and the scope of the engine class. The method used shall ensure that engines are recruited from more than one source. Methods used may include obtaining lists of engine owners from specific sources (e.g., engine manufacturers, motor vehicle registration records) and soliciting participation from owners, discussing with fleet or rental operations to locate engines in the engine class, or using methods used by the manufacturer to procure engines for the manufacturer-run heavy duty diesel in-use testing program established pursuant to 70 Federal Register 34594. In selecting engines for OBD emission testing, the Executive Officer shall include only engines meeting the criteria set forth in section (b)(3)(D)(i) below. For OBD ratio testing, the Executive Officer shall include only engines meeting the criteria set forth in section (b)(3)(D)(ii) below.

(ii) For all other testing, the Executive Officer shall, on a case by case basis, determine the appropriate manner for procuring engines. In making his or her determination, the Executive Officer shall consider the nature of the nonconformance and the scope of the engine class. The Executive Officer may procure engine(s) by any means that assures effective collection and testing of engines (e.g., rental car agencies, fleet vehicles, etc.), but shall not include any vehicle for which a reasonable basis exists that a vehicle operator's driving or maintenance habits would substantially impact test results to determine nonconformance. In all cases, however, the selection process must ensure proper selection of engines in accord with section (b)(3)(D)(iii) below.

(D) Engines to be included in a Test Sample Group.

(i) In selecting engines to be included in a test sample group for enforcement OBD emission testing, the Executive Officer shall include only engines that:

a. Are certified to the requirements of Cal. Code Regs., title 13, section 1971.1.1 and California exhaust emission standards.

b. Are registered for operation in the United States.

c. Have mileage that is less than 75 percent of the certified full useful life mileage and have an age of less than the certified full useful life age for the subject vehicles.

d. Have not been tampered with or equipped with add-on or modified parts that would cause the OBD system not to comply with the requirements of Cal. Code Regs., title 13, section 1971.1.1 or would have a permanent effect on exhaust emission performance

e. Have not been subjected to abuse (e.g., racing, overloading, misfueling), neglect, improper maintenance, or other factors that would cause the OBD system not to comply with the requirements of Cal. Code Regs., title 13, section 1971.1.1 or would have a permanent effect on exhaust emission performance.

f. Have no detected or known malfunction(s) unrelated to the monitor or system being evaluated that would affect the performance of the OBD system. At its discretion, ARB may elect to repair an engine with a detected or known malfunction and then include the engine in the test sample group.

g. Have had no major repair to the engine resulting from a collision.

h. Have no problem that might jeopardize the safety of laboratory personnel.

(ii) In selecting engines to be included in a test sample group for enforcement OBD ratio testing, the Executive Officer shall include only engines that:

a. Are certified to the requirements of Cal. Code Regs., title 13, section 1971.1.1.

b. Have collected sufficient engine operation data for the monitor to be tested. For monitors required to meet the in-use monitor performance ratio and to track and report ratio data pursuant to Cal. Code Regs., title 13, section 1971.1.1(d)(3.2), sufficient engine operation data shall mean the denominator meets the criteria set forth in sections (b)(3)(D)(ii)1. through 5. below. For monitors required to meet the in-use monitor performance ratio but not required to track and report ratio data pursuant to Cal. Code Regs., title 13, section 1971.1.1(d)(3.2), sufficient engine operation data shall mean that engines that have a denominator that meets the criteria set forth in sections (b)(3)(D)(ii)1. through 5. below after undergoing testing as set forth in section (b)(4)(C)(ii) below. Specifically, the denominator, as defined in Cal. Code Regs., title 13, section 1971.1.1(d)(4.3), for the monitor to be tested must have a value equal to or greater than:

1. 150 for gasoline evaporative system and secondary air system monitors, and gasoline monitors utilizing a denominator incremented in accordance with Cal. Code Regs., title 13, section 1971.1.1(d)(4.3.2)(D), (E), and (F) (e.g., cold start monitors, variable valve timing and/or control system monitors, etc.), or

2. 300 for gasoline catalyst, oxygen sensor, EGR, and all other component monitors.

3. 50 for diesel PM filter monitors, NMHC converting catalyst monitors, PM sensor monitors, and PM sensor heater monitors using a denominator incremented in accordance with Cal. Code Regs., title 13, section 1971.1.1(d)(4.3.2)(E), (F), (G) or (H), or

4. 150 for diesel monitors utilizing a denominator incremented in accordance with Cal. Code Regs., title 13, section 1971.1.1(d)(4.3.2)(D), (E), or (F) (e.g., cold start monitors, comprehensive component output component monitors, etc.) and not covered in section (b)(3)(D)(ii)3. above, or

5. 300 for all other diesel monitors not covered under sections (b)(3)(D)(ii)3. and 4. above.

c. Have not been tampered with or equipped with add-on or modified parts that would cause the OBD system not to comply with the requirements of Cal. Code Regs., title 13, section 1971.1.1.

d. Have mileage and age that are less than or equal to the certified full useful life mileage and age for the subject engines.

(iii) In selecting engines to be included in a test sample group for enforcement testing of any other requirement of Cal. Code Regs., title 13, section

1971.1.1 (not covered by sections (b)(3)(D)(i) or (ii) above), the Executive Officer shall include only engines that:

a. Are certified to the requirements of Cal. Code Regs., title 13, section 1971.1.1.

b. Have not been tampered with or equipped with add-on or modified parts that would cause the OBD system not to comply with the requirements of Cal. Code Regs., title 13, section 1971.1.1.

c. Have no detected or known malfunction(s) unrelated to the monitor or system being evaluated that would affect the performance of the OBD system. At its discretion, ARB may elect to repair an engine with a detected or known malfunction and then include the engine in the test sample group.

d. Have mileage and age that are less than or equal to the certified full useful life mileage and age for the subject engines.

(iv) If the Executive Officer discovers, by either evidence presented by the manufacturer as provided in section (b)(7) or on his or her own, that an engine fails to meet one or more of the applicable criteria of section (b)(3)(D)(i) through (iii), the Executive Officer shall remove the engine from the test sample group. The Executive Officer may replace any engine removed with an additional engine selected in accordance with sections (b)(3)(C) and (D) above. Test results relying on data from the removed engine shall be recalculated without using the data from the removed engine.

(4) *Enforcement Testing Procedures.*

(A) Prior to conducting any testing under section (b)(4), the Executive Officer may replace components monitored by the OBD system with components that are sufficiently deteriorated or simulated to cause malfunctions that exceed the malfunction criteria established pursuant to Cal. Code Regs., title 13, section 1971.1.1(e) through (g) in a properly operating system. The Executive Officer may not use components deteriorated or simulated to represent failure modes that could not have been foreseen to occur by the manufacturer (e.g., the use of leaded gasoline in an unleaded gasoline engine, etc.). Upon request by the Executive Officer, the manufacturer shall make available all test equipment used by the manufacturer in development, calibration, or demonstration testing (e.g., malfunction simulators, deteriorated "threshold" components, etc.) necessary to duplicate testing done by the manufacturer to determine the malfunction criteria used for major monitors subject to OBD emission testing.

(B) OBD Emission Testing. After the test sample group has been selected and procured, the Executive Officer may perform one or more of the following tests:

(i) Emission testing with the test procedures used by the Executive Officer for in-use testing of compliance with exhaust emission standards in accordance with Cal. Code Regs., title 13, section 1956.8(b) and (d).

(ii) On-road or engine or chassis dynamometer testing with the engine being operated in a manner that reasonably ensures that all of the monitoring conditions disclosed in the manufacturer's certification application for the tested monitor are encountered.

(C) OBD Ratio Testing.

(i) For OBD ratio testing of monitors required to meet the in-use monitor performance ratio and track and report ratio data pursuant to Cal. Code Regs., title 13, section 1971.1.1(d)(3.2), after the test sample group has been selected and procured, the Executive Officer shall download the data from monitors required to track and report such data.

(ii) For OBD ratio testing of monitors required to meet the in-use monitor performance ratio but not required to track and report ratio data pursuant to Cal. Code Regs., title 13, section 1971.1.1(d)(3.2), after the test sample group has been selected and procured, the Executive Officer shall collect data by installing instrumentation or data-logging equipment on the engines/vehicles. After installation of the equipment, the engines/vehicles shall be returned to the engine/vehicle owner/operator to continue to operate the engine/vehicle until the minimum denominator criteria (see section (b)(3)(D)(ii)b.) are satisfied. The Executive Officer shall then calculate the ratio from the data collected in accordance with the requirements of Cal. Code Regs., title 13, section 1971.1.1(d)(3.2) to allow the Executive Officer to effectively determine the in-use monitor performance ratio.

(D) Testing for compliance with any other requirement of Cal. Code Regs., title 13, section 1971.1.1. After the test sample group has been selected and procured, the Executive Officer may perform one or more of the following tests:

(i) Emission testing on the applicable FTP or supplemental emission test (SET) cycle or other applicable emission test cycle used for measuring exhaust or evaporative emissions;

(ii) On-road or engine or chassis dynamometer testing with the engine being operated in a manner that reasonably ensures that all of the monitoring conditions disclosed in the manufacturer's certification application for the tested monitor are encountered; or

(iii) Any other testing determined to be necessary by the Executive Officer. This may include, but is not limited to, the use of special test equipment to verify compliance with standardization requirements.

(5) *Additional Testing.*

(A) Based upon testing of the engine class in section (b)(4) above and after review of all evidence available at the conclusion of such testing, the Executive Officer may elect to conduct further testing of a subgroup of engines from the engine class if the Executive Officer has determined that:

(i) A subgroup of tested engines differs sufficiently enough from other engines in the tested engine class, and

(ii) A reasonable basis exists to believe that the identified differences may indicate that the subgroup may be nonconforming whereas the tested engine class as a whole is not.

(B) Hereinafter all references to engine class shall be applicable to the subgroup meeting the conditions of section (b)(5)(A) above.

(C) In any testing of a subgroup of engines under section (b)(5), the Executive Officer shall follow the engine selection and testing procedures set forth in sections (b)(3) and (4) above.

(6) *Finding of Nonconformance after Enforcement Testing.*

After conducting enforcement testing pursuant to section (b)(4) above, the Executive Officer shall make a finding of nonconformance of the OBD system in the identified engine class under the respective tests for the applicable model year(s) as follows:

(A) OBD Emission Testing.

(i) For 2010 through 2012 model year engines:

a. Engines certified as an OBD parent rating (i.e., the engine rating subject to the "full OBD" requirement under Cal. Code Regs., title 13, section 1971.1.1(d)(7.1.1)), shall be considered nonconforming if the emission test results indicate that 50 percent or more of the engines in the test sample group do not properly illuminate the MIL when emissions exceed 2.0 times the malfunction criteria (e.g., 5.0 times the standard if the malfunction criterion is 2.5 times the standard).

b. In determining an engine to be nonconforming, the Executive Officer shall use:

1. The test cycle and standard determined and identified by the manufacturer at the time of certification in accordance with Cal. Code Regs., title 13, section 1971.1.1(d)(6.1) as the most stringent for purposes of determining OBD system nonconformance with the applicable standard in section (b)(6)(A)(i)a. and

2.The adjustment factors determined by the manufacturer at the time of certification in accordance with Cal. Code Regs., title 13, section

1971.1.1(d)(6.2) for purposes of determining OBD system nonconformance in section (b)(6)(A)(i)a.

c. Engines certified as an OBD child rating (i.e., the engine ratings subject to the "extrapolated OBD" requirement under Cal. Code Regs., title 13, section 1971.1.1(d)(7.1.2)), may not be considered nonconforming based on testing emission levels.

(ii) For 2013 through 2015 model year engines:

a. All engines classified as OBD parent and child ratings subject to Cal. Code Regs., title 13, section 1971.1.1(d)(7.2.2) shall be considered to be nonconforming if the emission test results indicate that 50 percent or more of the engines in the test sample group do not properly illuminate the MIL when emissions exceed 2.0 times the malfunction criteria (e.g., 4.0 times the standard if the malfunction criterion is 2.0 times the standard).

b. In determining compliance, the Executive Officer shall use only the test cycle and standard determined and identified by the manufacturer at the time of certification in accordance with Cal. Code Regs., title 13, section 1971.1.1(d)(6.1) as the most stringent for purposes of determining OBD system nonconformance with the applicable standard in section (b)(6)(A)(ii)a.

c. All other engines and engine ratings may not be considered nonconforming based on the emission levels of the tests.

(iii) For 2016 through 2018 model year engines:

a. PM filter monitors on engines subject to the malfunction criteria of Cal. Code Regs., title 13, sections 1971.1.1(e)(8.2.1)(D) and (E) shall be considered to be nonconforming if the emission test results indicate that 50 percent or more of the engines in the test sample group do not properly illuminate the MIL when emissions exceed 2.0 times the malfunction criteria (e.g., PM emission level of 0.06 g/bhp-hr if the malfunction criterion is 0.03 g/bhp-hr) on any of the applicable standards (i.e., FTP or SET).

b. Monitors on engines and engine ratings previously certified to Cal. Code Regs., title 13, section 1971.1.1(d)(7.2.3) for extrapolated OBD in the 2013 through 2015 model years shall be considered nonconforming if the emission test results indicate that 50 percent or more of the engines in the test sample group do not properly illuminate the MIL when emissions exceed 2.0 times the malfunction criteria (e.g., 4.0 times the standard if the malfunction criterion is 2.0 times the standard) on any of the applicable standards (i.e., FTP or SET).

c. Monitors on engines not covered under sections (b)(6)(A)(iii)a. and b. above shall be considered nonconforming if the emission test results

indicate that 50 percent or more of the engines in the test sample group do not properly illuminate the MIL when emissions exceed the malfunction criteria on any of the applicable standards (i.e., FTP or SET).

(iv) For 2019 and subsequent model year engines, any engine shall be considered nonconforming if the results of the tests indicate that 50 percent or more of the engines in the test sample do not properly illuminate the MIL when emissions exceed the malfunction criteria on any of the applicable standards (i.e., FTP or SET).

(v) The Executive Officer may not consider an OBD system nonconforming solely due to a failure or deterioration mode of a monitored component or system that could not have been reasonably foreseen to occur by the manufacturer.

(B) OBD Ratio Testing.

(i) 2013 through 2015 model year engines certified to a ratio of 0.100 in accordance with Cal. Code Regs., title 13, section 1971.1.1(d)(3.2.2) and PM filter filtering performance monitors (section 1971.1.1(e)(8.2.1)) and missing substrate monitors (section 1971.1.1(e)(8.2.5)) on 2016 through 2018 model year engines shall be considered nonconforming if the data collected from the engines in the test sample group indicate either that the average in-use monitor performance ratio for one or more of the monitors in the test sample group is less than 0.050 or that 66.0 percent or more of the engines in the test sample group have an in-use monitor performance ratio of less than 0.050 for the same monitor.

(ii) Except as provided above in section (b)(6)(B)(i) above, 2016 and subsequent model year engines certified to a ratio of 0.100 in accordance with Cal. Code Regs., title 13, section 1971.1.1(d)(3.2.2) shall be considered nonconforming if the data collected from the engines in the test sample group indicate either that the average in-use monitor performance ratio for one or more of the monitors in the test sample group is less than 0.088 or that 66.0 percent or more of the engines in the test sample group have an in-use monitor performance ratio of less than 0.100 for the same monitor.

(C) All Other OBD Testing.

(i) Engines shall be considered nonconforming if the results of the testing indicate that at least 30 percent of the engines in the test sample group do not comply with the same requirement of Cal. Code Regs., title 13, section 1971.1.1.

(ii) Engines shall be considered nonconforming if the results of the testing indicate that at least 30 percent of the engines in the test sample group do not comply with one or more of the requirements of Cal. Code Regs., title 13, section 1971.1.1 while the engine is running and while in the key on,

engine off position such that off-board equipment designed to access the following parameters via the standards referenced in Cal. Code Regs., title 13, section 1971.1.1 for 2013 and subsequent model year engines cannot obtain valid and correct data for the following parameters:

a. The current readiness status from all on-board computers required to support readiness status in accordance with Society of Automotive Engineers J1979 (SAE J1979) or J1939 (SAE J1939) as incorporated by reference in Cal. Code Regs., title 13, section 1971.1.1(h)(1) and section 1971.1.1(h)(4.1);

b. The current MIL command status while the MIL is commanded off and while the MIL is commanded on in accordance with SAE J1979/J1939 and Cal. Code Regs., title 13, section 1971.1.1(h)(4.2), and in accordance with SAE J1979/J1939 and Cal. Code Regs., title 13, section 1971.1.1(d)(2.1.2) during the MIL functional check and, if applicable Cal. Code Regs., title 13, section 1971.1.1(h)(4.1.6) during the MIL readiness status check;

c. The current permanent fault code(s) in accordance with SAE J1979/J1939 and Cal. Code Regs., title 13, section 1971.1.1(h)(4.4);

d. The data stream parameters for: engine speed and OBD requirements to which the engine is certified as required in Cal. Code Regs., title 13, section 1971.1.1(h)(4.2) and in accordance with SAE J1979/J1939;

e. The CAL ID, CVN, ESN, and VIN as required in Cal. Code Regs., title 13, sections 1971.1.1(h)(4.6), (h)(4.7), and (h)(4.8) and in accordance with SAE J1979/J1939; or

f. The proper identification of all data identified in (b)(6)(C)(ii)a. through (b)(6)(C)(ii)e. as supported or unsupported as required in Cal. Code Regs., title 13, section 1971.1.1(h)(4) and in accordance with SAE J1979/J1939.

(iii) If the finding of nonconformance under section (b)(6)(C)(i) above concerns engines that do not comply with the requirements of Cal. Code Regs., title 13, section 1971.1.1(d)(4) or (5) (e.g., numerators or denominators are not properly being incremented), it shall be presumed that the nonconformance would result in an OBD ratio enforcement test result that would be subject to an ordered OBD-related recall in accord with the criterion in section (d)(3)(A)(i). The manufacturer may rebut such a presumption by presenting evidence in accord with section (b)(7)(C)(iii) below that demonstrates to the satisfaction of the Executive Officer that the identified nonconformance would not result in an ordered OBD- related recall under section (d)(3)(A)(i).

(7) *Executive Officer Notification to the Manufacturer Regarding Determination of*

Nonconformance.

(A) Upon making the determination of nonconformance in section (b)(6) above, the Executive Officer shall notify the manufacturer in writing.

(B) The Executive Officer shall include in the notice:

(i) a description of each group or set of engines in the engine class covered by the determination;

(ii) the factual basis for the determination, including a summary of the test results relied upon for the determination;

(iii) a statement that the Executive Officer shall provide to the manufacturer, upon request and consistent with the California Public Records Act, Government Code section 6250 et seq., all records material to the Executive Officer's determination;

(iv) a provision allowing the manufacturer no less than 90 days from the date of issuance of the notice to provide the Executive Officer with any information contesting the findings set forth in the notice; and

(v) a statement that if a final determination is made that the engine class is equipped with a nonconforming OBD system, the manufacturer may be subject to appropriate remedial action, including recall and monetary penalties.

(C) Within the time period set by the Executive Officer in section (b)(7)(B)(iv) and any extensions of time granted under section (b)(7)(H), the manufacturer shall provide the Executive Officer, consistent with paragraphs (i) through (iii) below, with any test results, data, or other information derived from engine testing that may rebut or mitigate the results of ARB testing, including any evidence that an engine class, if determined to be nonconforming, should be exempted from mandatory recall. (See section (d)(3)(B) below.).

(i) For OBD emission testing and OBD ratio testing:

a. The manufacturer may submit evidence to demonstrate that engines in the test sample group used by the Executive Officer were inappropriately selected, procured, or tested in support of a request to have engines excluded from the test sample group in accordance with section (b)(3)(D)(iv).

b. If the manufacturer elects to conduct additional testing of engines in the engine class and submit the results of such testing to the Executive Officer, the manufacturer shall:

1. Present evidence that it has followed the procurement and test procedures set forth in sections (b)(3) and (4) above, or

2. If the manufacturer elects to use different procurement and testing procedures, submit a detailed description of the procedures used and

evidence that such procedures provide an equivalent level of assurance that the results are representative of the engine class.

(ii) If the manufacturer objects to the size of the test sample group or the method used to procure engines in the test sample group used by the Executive Officer pursuant to section (b)(3)(B)(iii) or (b)(3)(C)(ii), the manufacturer shall set forth what it considers to be the appropriate size and procurement method, the reasons therefore, and test data from engines that confirm the manufacturer's position.

(iii) If the manufacturer elects to present evidence to overcome the presumption of nonconformance in section (b)(6)(C)(iii) above, the manufacturer shall demonstrate that the engines in the engine class comply with in-use monitor performance ratio requirements of Cal. Code Regs., title 13, section 1971.1.1(d)(3.2) by presenting:

a. Evidence in accord with the procurement and testing requirements of sections (b)(3) and (4).

b. Any other evidence that provides an equivalent level of proof that engines operated in California comply with the in-use monitor performance ratio requirements.

(D) The Executive Officer may accept any information submitted by a manufacturer pursuant to section (b)(7)(C) above after the time established for submission of such information has passed if the manufacturer could not have reasonably foreseen the need for providing the information within the time period provided. Otherwise, the Executive Officer is not required to accept late information. In determining whether to accept late information, the Executive Officer will consider the lateness of the submission, the manufacturer's reasons for why such information was not timely presented, the materiality of the information to the Executive Officer's final determination, and what effect any delay may have on effective enforcement and the health and welfare of the State.

(E) The requirements of section (b)(7) shall not be construed to abridge the manufacturer's right to assert any privilege or right provided under California law.

(F) After receipt of any information submitted by the manufacturer pursuant to section (b)(7)(C) above, the Executive Officer shall consider all information submitted by the manufacturer and may conduct any additional testing that he or she believes is necessary.

(G) Final Determination.

(i) Within 60 days after completing any additional testing that the Executive Officer deemed necessary under section (b)(7)(F) above, the Executive Officer shall notify the manufacturer of his or her final determination regarding the finding of nonconformity of the OBD system in the engine

class. The determination shall be made after considering all of the information collected and received, including all information that has been received from the manufacturer.

(ii) The notice must include a description of each engine family(ies), OBD group(s), or subgroups thereof, that has been determined to have a nonconforming OBD system and set forth the factual bases for the determination.

(H) Extensions. The Executive Officer may for good cause extend the time requirements set forth in section (b)(7). In granting additional time to a manufacturer, the Executive Officer shall consider, among other things, any documentation submitted by the manufacturer regarding the time that it reasonably believes is necessary to conduct its own testing, why such information could not have been more expeditiously presented, and what effect any delay caused by granting the extension may have on effective enforcement and the health and welfare of the State. The Executive Officer shall grant a manufacturer a reasonable extension of time upon the manufacturer demonstrating that despite the exercise of reasonable diligence, the manufacturer has been unable to produce relevant evidence in the time initially provided.

(c) *Manufacturer Self-Testing.*

(1) *Purpose.*

To assure that OBD systems on production engines certified on an engine dynamometer are able to detect a fault before emissions exceed the malfunction criteria established in Cal. Code Regs., title 13, sections 1971.1.1(e) through (g), engine manufacturers shall evaluate engines for each model year, starting with the 2010 model year.

(2) *Engine Selection for Manufacturer Self-Testing.*

(A) After OBD certification of all engines in the model year, a manufacturer shall submit a listing to the Executive Officer of all of the engine families and engine ratings within each family certified for that model year. The Executive Officer will then select the engine family(ies) and the specific engine rating within the engine family(ies) that the manufacturer shall use as a test engine for the test sample group to provide emission test data.

(i) For 2013 through 2015 model year engines, the Executive Officer may not select engines from OBD child ratings subject to "extrapolated OBD" under Cal. Code Regs., title 13, section 1971.1.1(d)(7.2.3).

(B) Number of test engines.

(i) For the 2010 model year, a manufacturer shall provide emission test data of a test engine from the OBD parent rating.

(ii) For the 2013 and subsequent model years, a manufacturer certifying one to five engine families in a model year shall provide emission test data of a test engine from one engine rating. A manufacturer certifying six to ten engine families in a model year shall provide emission test data from test engines from two engine ratings. A manufacturer certifying eleven or more engine families in a model year shall provide emission test data of test engines from three engine ratings. The Executive Officer may waive the requirement for submittal of data of one or more of the test engines if data have been previously submitted for all of the engine ratings.

(C) Engines to be included in test sample group.

(i) In selecting engines to be included in a test sample group for manufacturer self-testing, the manufacturer shall include only engines that:

a. Are certified to the requirements of Cal. Code Regs., title 13, section 1971.1.1 and California exhaust emission standards.

b. Are used in vehicles registered for operation in the United States.

c. Have mileage that is between 70 to 80 percent of the certified full useful life mileage and an age of less than the certified full useful life age for the subject engines.

d. Have not been tampered with or equipped with add-on or modified parts that would cause the OBD system not to comply with the requirements of Cal. Code Regs., title 13, section 1971.1.1 or would have a permanent effect on exhaust emission performance.

e. Have not been subjected to abuse (e.g., overloading, misfueling) neglect, improper maintenance, or other factors that would cause the OBD system not to comply with the requirements of Cal. Code Regs., title 13, section 1971.1.1 or would have a permanent effect on exhaust emission performance.

f. Have no detected or known malfunction(s) unrelated to the monitor or system being evaluated that would affect the performance of the OBD system. With request to and approval from the Executive Officer, the manufacturer may elect to repair an engine with a detected or known malfunction and then include the engine in the test sample group.

g. Have had no major repair to the engine resulting from a collision.

h. Have no problem that might jeopardize the safety of laboratory personnel.

(ii) If the manufacturer discovers, by either evidence presented by the Executive Officer or on its own, that an engine fails to meet one or more of the applicable criteria of section (c)(2)(C)(i), the manufacturer shall notify the Executive Officer of its findings and request approval to remove the engine from the test sample group. If approved by the Executive Officer,

the manufacturer shall replace any engine removed with an additional engine selected in accordance with section (c)(2)(C)(i). Test results relying on data from the removed engine shall be recalculated without using the data from the removed engine.

(3) *Compliance/Enforcement Testing Procedures.*

(A) Within three calendar years after the model year of the engine (e.g., by the end of calendar year 2013 for a 2010 model year engine), the engine manufacturer shall complete the testing required under section (c)(3).

(B) Prior to conducting any testing under section (c)(3), the engine manufacturer shall replace components monitored by the OBD system with components that are sufficiently deteriorated or simulated to cause malfunctions that exceed the malfunction criteria established pursuant to Cal. Code Regs., title 13, sections 1971.1.1(e) through (g) in a properly operating system. The engine manufacturer may not use components deteriorated or simulated to represent failure modes that could not have been foreseen to occur by the manufacturer (e.g., the use of leaded gasoline in an unleaded engine, etc.).

(C) After the test engine(s) has been selected and procured under section (c)(2) above, the engine manufacturer shall perform emission testing for all applicable components/systems according to the certification demonstration testing requirements of Cal. Code Regs., title 13, sections 1971.1.1(i)(3) and (i)(4).

(D) No modifications or replacement of components to make the engine compatible with engine dynamometer testing (e.g., replacement of an air-to-air charge cooler with a water-to-air charge cooler) shall be done without approval by the Executive Officer. The Executive Officer shall approve such requests upon the manufacturer documenting the technical need for such a modification or replacement and providing engineering data or analysis demonstrating that any such modified part will be configured to simulate the current performance of the actual part removed from the engine (e.g., the water-to-air cooler must be configured to perform similarly to the air-to-air cooler in its current state of aging/deterioration, not to the performance specifications of the air-to-air cooler when new or to the manufacturer's specifications or performance characteristics used on the water-to-air cooler when the engine was originally certified).

(E) Upon request of the manufacturer, the Executive Officer may extend the deadline set forth in section (c)(3)(A) or reduce the minimum mileage required in section (c)(2)(C)(i)c. upon finding that the manufacturer has demonstrated good cause for the requested extension or mileage reduction.

(F) Upon request of the manufacturer, the Executive Officer may approve other compliance/enforcement testing protocols for (c)(3). The Executive Officer shall approve the request upon the manufacturer demonstrating that other testing protocol will provide comparable assurance that the in-use engines

comply with the malfunction criteria established pursuant to Cal. Code Regs., title 13, sections 1971.1.1(e) through (g).

(4) *Additional Testing.*

(A) If the results of the OBD emission tests conducted under section (c)(3) indicate that the OBD system properly illuminates the MIL for all component/system monitors before emissions exceed the malfunction criteria defined in Cal. Code Regs., title 13, sections 1971.1.1(e) through (g), no further testing is required.

(B) If the results of the OBD emission tests conducted under section (c)(3) indicate that OBD system does not properly illuminate the MIL for one or more of the component/system monitor(s) before emissions exceed the malfunction criteria defined in Cal. Code Regs., title 13, sections 1971.1.1(e) through (g), the engine manufacturer shall conduct further testing on additional engines.

(i) Within six months after the completion of testing required in section (c)(3), the engine manufacturer shall emission test an additional four engines from the same engine rating and engine family as the test engine.

(ii) The engine manufacturer shall only be required to test the component/system monitor(s) for which the OBD emission test results in (b)(3) exceeded the malfunction criteria defined in Cal. Code Regs., title 13, sections 1971.1.1(e) through (g).

(C) For manufacturers subject to section (c)(4)(B) above, no further testing is required if the results of the OBD emission tests conducted under section (c)(4)(B) indicate that OBD system properly illuminates the MIL for the tested component/system monitor(s) before emissions exceed the malfunction criteria defined in Cal. Code Regs., title 13, sections 1971.1.1(e) through (g) on three or more of the additional test engines.

(D) For manufacturers subject to section (c)(4)(B) above, if the results of the OBD emission tests conducted under section (c)(4)(B) indicate that the OBD system does not properly illuminate the MIL for one or more of the tested component/system monitor(s) before emissions exceed the malfunction criteria defined in Cal. Code Regs., title 13, sections 1971.1.1(e) through (g) on two or more of the additional test engines, the engine manufacturer shall conduct further testing.

(i) Within six months after the completion of testing required in section (c)(4)(B), the engine manufacturer shall test an additional five engines from the same engine rating and engine family as the previously tested engines.

(ii) The engine manufacturer shall test only the component/system monitor(s) for which the OBD emission test results exceeded the malfunction criteria defined in Cal. Code Regs., title 13, sections 1971.1.1(e) through (g).

(E) In any testing of the additional engines under section (c)(4), the engine manufacturer shall follow the engine selection and testing procedures set forth in sections (c)(2) and (c)(3) above.

(5) *ARB Authority to Observe Testing.* The Executive Officer may elect to have ARB personnel observe the testing under sections (c)(3) and (c)(4) above.

(A) During conducting of the test procedures described in sections (c)(3) and (c)(4) above, an engine manufacturer, upon receipt of prior notice, must admit or cause to be admitted during operating hours any ARB personnel that has presented proper credentials to any of the following:

(i) Any facility where tests or procedures or activities connected with such tests or procedures are performed;

(ii) Any facility where a manufacturer procures, inspects, screens, removes from vehicles, works on, configures, or modifies engines for testing; and

(iii) Any facility where any record or other document relating to any of the above is located.

(B) Upon admission to any facility referred to in section (c)(5)(A) above, any ARB personnel must be allowed to:

(i) Inspect and monitor any part or aspect of such procedures, activities, and testing facilities, including monitoring engine preconditioning, emissions tests, and break-in, maintenance, and engine storage procedures;

(ii) Verify correlation or calibration of test equipment;

(iii) Inspect and make copies of any such records, designs, or other documents; and

(iv) Inspect and/or photograph any part or aspect of any such tested engine and any components or equipment used in the testing thereof.

(C) Any ARB personnel must be furnished by those in charge of a facility being inspected with such reasonable assistance as may be necessary to discharge any function listed in section (c)(5)(B) above. The engine manufacturer is required to cause those in charge of a facility operated for its benefit to furnish such reasonable assistance without charge to ARB irrespective of whether or not the engine manufacturer controls the facility.

(D) The duty to admit or cause to be admitted any ARB personnel applies whether or not the engine manufacturer owns or controls the facility in question and applies both to the domestic and foreign engine manufacturers and facilities. If ARB personnel are prohibited from admission, the Executive Officer may reject any data produced by the manufacturer and may presume that the tested engines do not conform to certification standards. In such circumstances, the Executive Officer may suspend or revoke the engine's certification or take other necessary corrective action.

(E) For purposes of section (c)(5):

(i) "Presentation of credentials" means a display of a document designating a person as an ARB employee.

(ii) Where engine, component, or engine storage areas or facilities are concerned, "operating hours" means all times during which employees are at work in the vicinity of the area or facility and have access to it.

(iii) Where facilities or areas other than those covered by paragraph (c)(5)(E)(ii) above are concerned, "operating hours" means all times during which an assembly line is in operation or during which testing, maintenance, break-in procedure, production or compilation of records, or any other procedure or activity is being conducted related to certification testing, translation of designs from the test stage to the production stage, or engine manufacture or assembly.

(iv) "Reasonable assistance" includes providing clerical, copying, interpretation and translation services, making personnel available upon request to inform ARB personnel of how the facility operates and to answer questions, and performing requested emissions test on any engine that is being, has been, or will be used for certification testing. Such tests must be nondestructive, but may require appropriate break-in. Upon service of a written request from the Executive Officer for the appearance of any employee at a facility qualified for reasonable assistance, the engine manufacturer shall cause the personal appearance of such qualified employee to appear before and assist ARB personnel.

(6) *Manufacturer Reporting of Self-Testing Results to the Executive Officer.*

(A) Within 30 days after completing the testing under section (c)(3), the manufacturer shall submit a report of the results of all the testing to the Executive Officer for review. If further testing is required under section (c)(4), an additional report shall be submitted within 30 days of completing the additional testing. The report(s) must include the following:

(i) A description of each test engine and the engine family and engine rating to which the test engine belongs to;

(ii) A description of the test sequence (e.g., the number and types of preconditioning cycles) used for each testing;

(iii) A description of the modified or deteriorated components used for fault simulation with respect to each testing; and

(iv) The test results of all testing done under sections (c)(3) and (c)(4) for each test engine, consisting of:

a. the weighted emission test results for all measured pollutants for each test; and

b. the OBD data specified by Cal. Code Regs., title 13, section 1971.1.1(i)(4.3.2) collected prior to (or immediately after) each engine shut-down during the testing of sections (c)(3) and (c)(4) including the preconditioning cycles.

(7) *Finding of Nonconformance after Manufacturer Self-Testing.*

After the engine manufacturer has conducted testing pursuant to sections (c)(3) and (c)(4) and the Executive Officer has received the test results pursuant to section (c)(6) above, the Executive Officer shall make a finding of nonconformance of the OBD system in the engine class according to the criteria of section (b)(6)(A).

(8) *Executive Officer Notification to the Manufacturer Regarding Determination of Nonconformance.*

Upon making the determination of nonconformance in section (c)(7) above, the Executive Officer shall follow the procedures and requirements of section (b)(7).

(d) *Remedial Action.*

(1) *Voluntary OBD-Related Recalls.*

If a manufacturer initiates a voluntary OBD-related recall campaign, the manufacturer shall notify the Executive Officer of the recall at least 45 days before owner notification is to begin. The manufacturer shall also submit a voluntary OBD-related recall plan for approval, as prescribed under section (e)(1) below. A voluntary recall plan shall be deemed approved unless disapproved by the Executive Officer within 30 days after receipt of the recall plan.

(2) *Influenced OBD-Related Recalls.*

(A) Upon being notified by the Executive Officer, pursuant to section (b)(7)(G), that an engine class is equipped with a nonconforming OBD system, the manufacturer may, within 45 days from the date of service of such notification, elect to conduct an influenced OBD-related recall of all engines within the engine class for the purpose of correcting the nonconforming OBD systems. Upon such an election, the manufacturer shall, within 45 days from the date of such election, submit an influenced OBD-related recall plan for approval, as prescribed under section (e)(1) below.

(B) If a manufacturer does not elect to conduct an influenced OBD-related recall under section (d)(2)(A) above, the Executive Officer may order the manufacturer to undertake appropriate remedial action, up to and including the recall and repair of the nonconforming OBD systems.

(3) *Ordered Remedial Action-Mandatory Recall.*

(A) Except as provided in sections (d)(3)(B) below, the Executive Officer shall order the recall and repair of all engines in an engine class that have been determined to be equipped with a nonconforming OBD system if enforcement

testing conducted pursuant to sections (b) or (c) above or information received from the manufacturer indicates that:

(i) For major monitors required to meet the in-use performance ratio pursuant to Cal. Code Regs., title 13, section 1971.1.1(d)(3.2) and subject to the nonconformance criteria of section (b)(6)(B)(ii) on 2016 and subsequent model year engines, the average in-use monitor performance ratio for one or more of the major monitors in the test sample group is less than or equal to 33.0 percent of the applicable required minimum ratio established in Cal. Code Regs., title 13, section 1971.1.1(d)(3.2.2) (e.g., if the required ratio is 0.100, less than or equal to a ratio of 0.033) or 66.0 percent or more of the vehicles in the test sample group have an in-use monitor performance ratio of less than or equal to 33.0 percent of the applicable required minimum ratio established in Cal. Code Regs., title 13, section 1971.1.1(d)(3.2.2) for the same major monitor.

(ii) For major monitors required to indicate a malfunction before emissions exceed a certain emission threshold, when the engine is tested in a vehicle and operated so as to reasonably encounter all monitoring conditions disclosed in the manufacturer's certification application, the OBD system is unable to detect and illuminate the MIL for a malfunction of a component/system monitored by the major monitor prior to emissions exceeding:

a. For 2013 through 2015 model year OBD parent and child ratings subject to the "full OBD" requirement under Cal. Code Regs., title 13, section 1971.1.1(d)(7.2.2), three times the applicable major monitor malfunction criteria (e.g., if the malfunction criteria is 2.5 times the applicable standard, recall would be required when emissions exceed 7.5 times the applicable standard, or if the malfunction criteria is the PM standard plus 0.02 g/bhp-hr and the PM standard is 0.01 g/bhp-hr, recall would be required when emissions exceeded 0.09 g-bhp-hr).

b. For 2016 through 2018 model year engines:

1. For engine ratings previously certified to Cal. Code Regs., title 13, section 1971.1.1(d)(7.2.3) for "extrapolated OBD" in the 2013 through 2015 model years, three times the applicable major monitor malfunction criteria (e.g., if the malfunction criteria is 2.5 times the applicable standard, recall would be required when emissions exceed 7.5 times the applicable standard, or if the malfunction criteria is the PM standard plus 0.02 g/bhp-hr and the PM standard is 0.01 g/bhp-hr, recall would be required when emissions exceeded 0.09 g-bhp-hr), and

2. For all other engine ratings, three times the malfunction criteria for PM filter monitors subject to Cal. Code Regs., title 13, sections 1971.1.1(e)(8.2.1)(D) and (E) (e.g., if the malfunction criteria is the PM standard plus 0.02 g/bhp-hr and the PM standard is 0.01 g/bhp-

hr, recall would be required when emissions exceeded 0.09 g-bhp-hr) and two times the malfunction criteria for all other applicable major monitors.

c. For 2019 and subsequent model year engines, two times the applicable major monitor malfunction criteria (e.g., if the malfunction criteria is 2.5 times the applicable standards, recall would be required when emissions exceed 5.0 times the applicable standards).

(iii) For misfire monitor:

a. Gasoline misfire monitor: For 2016 and subsequent model year gasoline engines, the monitor for misfire causing catalyst damage is unable to properly detect and illuminate the MIL for misfire rates that are more than 20 percentage points greater than the misfire rates disclosed by the manufacturer in its certification application as causing catalyst damage (e.g., if the disclosed misfire rate is 12 percent, recall would be required if the misfire rate is greater than 32 percent without proper detection).

b. Diesel misfire monitor: For 2019 and subsequent model year diesel engines, the misfire monitor is unable to properly detect and illuminate the MIL for misfire rates that are more than 10 percentage points greater than the misfire malfunction criteria specified in section Cal. Code Regs., title 13, section 1971.1.1(e)(2.2.2) (e.g., misfire rate more than 15 percent if the misfire malfunction criteria is 5 percent).

(iv) For 2016 and subsequent model year gasoline engines, when the engine is tested in a vehicle and operated so as to reasonably encounter all monitoring conditions disclosed in the manufacturer's certification application, the evaporative system monitor is unable to detect and illuminate the MIL for a cumulative leak or leaks in the evaporative system equivalent to that caused by an orifice with a diameter of at least 1.5 times the diameter of the required orifice in Cal. Code Regs., title 13, section 1971.1.1(f)(7.2.2)(B).

(v) When the engine is tested in a vehicle and operated so as to reasonably encounter all monitoring conditions disclosed in the manufacturer's certification application, the OBD system cannot detect and illuminate the MIL for a malfunction of a component that effectively disables a major monitor and the major monitor, by being disabled, meets the criteria for recall identified in sections (d)(3)(A)(ii) or (iv) above (e.g. is unable to detect and illuminate the MIL for malfunctions that cause FTP emissions to exceed two times the malfunction criteria).

(vi) For 2013 and subsequent model year diesel engines, when the engine is tested in a vehicle and operated so as to reasonably encounter all monitoring conditions disclosed in the manufacturer's certification application, the PM filter monitor is unable to detect and illuminate the MIL for any of the following:

a. a missing substrate fault in accordance with title 13, CCR section 1971.1.1(e)(8.2.5); or

b. a malfunction of the PM filter that causes PM emissions to be equal to or greater than the emission level of the engine, as measured from an applicable emission test cycle (i.e., FTP or SET), with the PM filter substrate completely removed.

(vii) The engine class cannot be tested so as to obtain valid test results in accordance with the criteria identified in section (b)(6)(C)(ii) due to the nonconforming OBD system.

(B) An engine class shall not be subject to mandatory recall if the Executive Officer determines that, even though a monitor meets a criterion set forth in section (d)(3)(A)(i)-(vi) for mandatory recall:

(i) The OBD system can still detect and illuminate the MIL for all malfunctions monitored by the nonconforming monitor (e.g., monitor "A" is non-functional but monitor "B" is able to detect all malfunctions of the component(s) monitored by monitor "A").

(ii) The monitor meets the criterion solely due to a failure or deterioration mode of a monitored component or system that could not have been reasonably foreseen to occur by the manufacturer.

(iii) The failure or deterioration of the monitored component or system that cannot be properly detected causes the engine to be unoperable (e.g., engine stalls continuously or the transmission will not shift out of first gear, etc.) or causes an overt indication such that the operator is certain to respond and have the problem corrected (e.g., illumination of an over-temperature warning light or charging system light that uncorrected will result in an undriveable vehicle, etc.).

(C) A motor vehicle class that is not subject to mandatory recall pursuant to paragraph (d)(3)(B) may still be subject to remedial action pursuant to section (d)(4) below.

(4) *Other Ordered Remedial Action.*

(A) If the Executive Officer has determined based upon enforcement testing conducted pursuant to sections (b) or (c) above or information received from the manufacturer that an engine class is equipped with a nonconforming OBD system and the nonconformance does not fall within the provisions of section (d)(3), he or she may require the manufacturer to undertake remedial action up to and including recall of the affected engine class.

(B) In making his or her findings regarding remedial action, the Executive Officer shall consider the capability of the OBD system to properly function. This determination shall be based upon consideration of all relevant circumstances including, but not limited to, those set forth below.

(i) Whether the manufacturer identified and informed ARB about the nonconformance(s) or whether ARB identified the nonconformance(s) prior to being informed by the manufacturer.

(ii) The number of nonconformances.

(iii) If the identified nonconformance(s) is with a major monitor(s), the nature and extent of the nonconformance(s), including:

a. the degree to which the in-use monitor performance ratio(s) is below the required ratio(s) specified in Cal. Code Regs., title 13, section 1971.1.1(d)(3.2.2), and

b. the amount of the emission exceedance(s) over the established malfunction criteria set forth in Cal. Code Regs., title 13, sections 1971.1.1(e) through (g) before a malfunction is detected and the MIL is illuminated.

(iv) If the identified nonconformance(s) is with a non-major monitor, the nature and extent of the nonconformance(s), including:

a. the degree to which the in-use monitor performance ratio(s) (where applicable) is below the required ratio(s) specified in Cal. Code Regs., title 13, section 1971.1.1(d)(3.2.2),

b. the degree to which the monitored component must be malfunctioning or exceed the established malfunction criteria set forth in Cal. Code Regs., title 13, sections 1971.1.1(e) through (g) before a malfunction is detected and the MIL is illuminated, and

c. the effect that the nonconformance(s) has on the operation of a major monitor(s).

(v) The impact of the nonconformance on vehicle or engine owners (e.g., cost of future repairs, driveability, etc.) and the ability of the service and repair industry to make effective repairs (e.g., difficulty in accessing fault information, diagnosing the root cause of a failure, etc.).

(vi) The degree to which the identified nonconformance(s) complicates, interferes with, disrupts, or hampers a service technician's or inspector's ability to perform a California heavy-duty vehicle or engine inspection.

(vii) The failure of the data link connector of the engine class to meet the requirements of Cal. Code Regs., title 13, section 1971.1.1(h)(2).

(viii) The failure of the crankcase ventilation system in the engine class to comply with the requirements of Cal. Code Regs., title 13, section 1971.1.1(g)(2).

(ix) The failure of the cooling system monitor in the engine class to properly verify that the cooling system reaches the highest enable temperature used for any other monitor when the engine is operated in a vehicle in the

monitoring conditions disclosed in the manufacturer's certification application, or failure to comply with any requirement in Cal. Code Regs., title 13, section 1971.1.1(g)(1).

(x) The estimated frequency that a monitor detects a malfunction and illuminates the MIL when no component malfunction is present (i.e., false MILs).

(xi) The estimated frequency that a monitor fails to detect a malfunction and illuminate the MIL when the monitoring conditions, as set forth in the manufacturer's approved certification application, have been satisfied and a faulty or deteriorated monitored component is present (i.e., false passes).

(xii) Whether the manufacturer submitted false, inaccurate, or incomplete documentation regarding the identified nonconformance at the time of certification pursuant to Cal. Code Regs., title 13, section 1971.1.1(j) and the extent to which the false, inaccurate, or incomplete documentation was material to the granting of certification.

(C) In making the determination, the average tailpipe and evaporative emissions of engines within the affected engine class shall not be considered.

(5) *Assessment of Monetary Penalties.*

The Executive Officer may seek penalties pursuant to the applicable provisions of the Health and Safety Code for violations of the requirements of Cal. Code Regs., title 13, section 1971.1.1 or for production engines otherwise failing to be equipped with OBD systems that have been certified by ARB. In determining the penalty amounts that ARB may seek, the Executive Officer shall consider all relevant circumstances including the factors set forth below:

(A) Whether the manufacturer self-reported the nonconformity or ARB discovered the nonconformity independent of the manufacturer.

(B) The nature and degree of the nonconformity and whether the manufacturer should reasonably have discovered the nonconformity and taken corrective action by voluntary OBD-related recall or running changes during the production year.

(C) The economic benefits, if any, gained by the manufacturer from not complying with the provisions of Cal. Code Regs., title 13, section 1971.1.1.

(D) The manufacturer's history of compliance with the OBD requirements.

(E) The preventative efforts taken by the manufacturer to avoid nonconformance, including any programs followed by the manufacturer to ensure compliance.

(F) The manufacturer's efforts to correct the nonconformity once it was identified.

(G) The innovative nature and magnitude of effort, including the cost of any other proposed remedial action, necessary to correct the nonconformity.

(H) The deterrent effect of the penalty.

(I) Whether the manufacturer has failed to provide complete and accurate information required to be submitted at the time of certification pursuant to Cal. Code Regs., title 13, section 1971.1.1(j).

(J) The nature and degree that OBD systems on production engines differ from the systems that have been certified by ARB.

(6) *Notice to Manufacturer for an Ordered Remedial Action.*

(A) The Executive Officer shall immediately notify the manufacturer upon the Executive Officer determining the type of remedial action to be taken.

(B) For remedial actions other than the assessment of monetary penalties, the notice must:

(i) specifically set forth the remedial action that is being ordered,

(ii) include a description of the engine family(ies), OBD group(s), or subgroup(s) thereof, that has been determined to have a nonconforming OBD system,

(iii) set forth the factual bases for the determination, and

(iv) designate a date at least 45 days from the date of receipt of such notice by which the manufacturer shall submit a plan, pursuant to section (e)(1) below, outlining the remedial action to be undertaken consistent with the Executive Officer's order. Except as provided in section (d)(7)(C) below, all plans shall be submitted to the Chief, Emissions Certification and Compliance Division, 4001 Iowa Avenue, Riverside, California 92507, within the time limit specified in the notice. The Executive Officer may grant the manufacturer an extension of time for good cause.

(C) For cases in which ARB elects to seek monetary penalties pursuant to authority granted under the Health and Safety Code, the Executive Officer shall issue a notice to the manufacturer that he or she will be filing a complaint in the appropriate administrative or civil court forum seeking penalties against the manufacturer for violations of Cal. Code Regs., title 13, section 1971.1.1. The notice must include a description of the engine family(ies), OBD group(s), or subgroup(s) thereof, that have been determined to have a nonconforming OBD system and set forth the factual bases for the determination.

(7) *Availability of Public Hearing to Contest Remedial Actions Other than Determination to Seek Monetary Penalties.*

(A) Within 45 days from the date of receipt of the notice that is required under section (d)(6) above, the manufacturer may request a public hearing pursuant to the procedures set forth in Cal. Code Regs., title 17, section 60055.1, et seq., to contest the findings of nonconformity, the necessity for, or the scope of any ordered remedial action. Pursuant to those procedures, the Executive Officer has the initial burden of presenting evidence that those parts of the

Executive Officer's determination specifically challenged are supported by the facts and applicable law. (Cal. Code Regs., title 17, §60055.32(d)(1).) Each issue of controversy shall be decided based upon the preponderance of the evidence presented at the hearing. (Cal. Code Regs., title 17, §60055.32(h).)

(B) Notwithstanding the provisions of Cal. Code Regs., title 17, section 60055.17(a)(1), administrative hearings conducted pursuant to a request filed under section (c)(7)(A) above shall be referred to the Office of Administrative Hearings, which shall otherwise follow the procedures established in Cal. Code Regs., title 17, section 60055.1 et seq.

(C) If a manufacturer requests a public hearing pursuant to section (d)(7)(A) above and if the Executive Officer's determination of nonconformity is confirmed at the hearing, the manufacturer shall submit the required remedial action plan in accordance with section (e)(1) below within 30 days after receipt of the Board's decision.

(e) *Requirements for Implementing Remedial Actions.*

(1) *Remedial Action Plans.*

(A) A manufacturer initiating a remedial action (voluntary, influenced, or ordered), other than payment of monetary penalties, shall develop a remedial action plan that contains the following information, unless otherwise specified:

(i) A description of each engine family, OBD group, or subgroup thereof covered by the remedial action, including the number of engines, the engine families, or subgroups within the identified class(es), the make(s), model(s), and model years of the covered engines, and such other information as may be required to identify the covered engines.

(ii) A description of the nonconforming OBD system and, in the case of a recall (whether voluntary, influenced, or ordered), the specific modifications, alterations, repairs, adjustments, or other changes to correct the nonconforming OBD system, including data and/or engineering evaluation supporting the specific corrections.

(iii) A description of the method that the manufacturer will use to determine the names and addresses of vehicle or engine owners and the manufacturer's method and schedule for notifying the service facilities and vehicle or engine owners of the remedial action.

(iv) A copy of all instructions that the manufacturer will use to notify service facilities about the required remedial action and the specific corrections, if any, that will be required to be made to the nonconforming OBD systems.

(v) A description of the procedure to be followed by vehicle/engine owners to obtain remedial action for the nonconforming OBD system. This must include the date on or after which the owner can have required remedial action performed, the time reasonably necessary to perform the labor to

remedy the nonconformity, and the designation of facilities at which the nonconformity can be remedied.

(vi) If some or all of the nonconforming OBD systems are to be remedied by persons other than dealers or authorized warranty agents of the manufacturer, a description of such class of service agents and what steps, including a copy of all instructions mailed to such service agents, the manufacturer will take to assure that such agents are prepared and equipped to perform the proposed remedial action.

(vii) A copy of the letter of notification to be sent to vehicle or engine owners.

(viii) A proposed schedule for implementing the remedial action, including identified increments of progress towards full implementation.

(ix) A description of the method that the manufacturer will use to assure that an adequate supply of parts will be available to initiate the remedial action campaign on the date set by the manufacturer and that an adequate supply of parts will continue to be available throughout the campaign.

(x) A description and test data of the emission impact, if any, that the proposed remedial action may cause to a representative engine from the engine class to be remedied.

(xi) A description of the impact, if any, and supporting data and/or engineering evaluation that the proposed remedial action will have on fuel economy, driveability, performance, and safety of the engine class covered by the remedial action.

(xii) Any other information, reports, or data which the Executive Officer may reasonably determine to be necessary to evaluate the remedial action plan.

(B) Approval and Implementation of Remedial Action Plans.

(i) If the Executive Officer finds that the remedial action plan is designed effectively to address the required remedial action and complies with the provisions in section (e)(1)(A) above, he or she shall notify the manufacturer in writing within 30 days of receipt of the plan that the plan has been approved.

(ii) The Executive Officer shall approve a voluntary, influenced, or ordered remedial action plan if the plan contains the information specified in section (e)(1)(A) above and is designed to notify the vehicle or engine owner and implement the remedial action in an expeditious manner.

(iii) In disapproving an ordered remedial action plan, the Executive Officer shall notify the manufacturer in writing of the disapproval and the reasons for the determination. The manufacturer shall resubmit a revised remedial action plan that fully addresses the reasons for the Executive Officer's disapproval within 10 days of receipt of the disapproval notice.

(iv) Upon receipt of the approval notice of the ordered remedial action plan from the Executive Officer, the manufacturer shall, within 45 days of receipt of the notice, begin to notify vehicle or engine owners and implement the remedial action campaign.

(v) If the Executive Officer disapproves a voluntary or influenced remedial action plan, the manufacturer shall either accept the proposed modifications to the plan as suggested by the Executive Officer, resubmit a revised remedial action plan that fully addresses the reasons for the Executive Officer's disapproval within 30 days or be subject to an Executive Officer order that the manufacturer undertake appropriate remedial action pursuant to section (d)(2)(B) above.

(vi) Upon receipt of the voluntary or influenced remedial action approval notice from the Executive Officer, the manufacturer shall begin to notify vehicle or engine owners and implement the remedial action campaign according to the schedule indicated in the remedial action plan.

(2) *Eligibility for Remedial Action.*

(A) The manufacturer may not condition a vehicle or engine owner's eligibility for remedial action required under section 1971.5.1 on the proper maintenance or use of the engine.

(B) The manufacturer shall not be obligated to repair a component which has been modified or altered such that the remedial action cannot be performed without additional cost.

(3) *Notice to Owners.*

(A) The manufacturer shall notify owners of vehicles or engines in the engine class covered by the remedial order. The notice must be made by first-class mail or by such other means as approved by the Executive Officer. When necessary, the Executive Officer may require the use of certified mail for ordered remedial actions to assure effective notification.

(B) The manufacturer shall use all reasonable means necessary to locate vehicle or engine owners, including motor vehicle registration lists available from the California Department of Motor Vehicles and commercial sources such as R.L. Polk & Co.

(C) The notice must contain the following:

(i) For ordered remedial actions, a statement: "The California Air Resources Board has determined that your (vehicle or engine) (is or may be) equipped with an improperly functioning on-board emission-related diagnostic system that violates established standards and regulations that were adopted to protect your health and welfare from the dangers of air pollution."

(ii) For voluntary and influenced remedial actions, a statement: "Your (vehicle or engine) (is or may be) equipped with an improperly functioning on-board

emission-related diagnostic system that violates (California or California and Federal) standards and regulations" if applicable as determined by the Executive Officer.

(iii) A statement that the nonconformity of any such engines will be remedied at the expense of the manufacturer.

(iv) A statement that eligibility for remedial action may not be denied solely on the basis that the vehicle or engine owner used parts not manufactured by the original equipment engine manufacturer, or had repairs performed by outlets other than the engine manufacturer's franchised dealers.

(v) Instructions to the vehicle or engine owners on how to obtain remedial action, including instructions on whom to contact (i.e., a description of the facilities where the vehicles or engines should be taken for the remedial action), the first date that a vehicle or engine may be brought in for remedial action, and the time that it will reasonably take to correct the nonconformity.

(vi) The statement: "In order to assure your full protection under the emission warranty provisions, it is recommended that you have your (vehicle or engine) serviced as soon as possible. Failure to do so could be determined as lack of proper maintenance of your (vehicle or engine)."

(vii) A telephone number for vehicle or engine owners to call to report difficulty in obtaining remedial action.

(viii) A card to be used by a vehicle or engine owner in the event the vehicle or engine to be recalled has been sold. Such card should be addressed to the manufacturer, have postage paid, and shall provide a space in which the owner may indicate the name and address of the person to whom the vehicle or engine was sold or transferred.

(ix) If the remedial action involves recall, the notice must also provide:

a. A clear description of the components that will be affected by the remedial action and a general statement of the measures to be taken to correct the nonconformity.

b. A statement that such nonconformity, if not corrected, may cause the vehicle or engine to fail an emission inspection.

c. A statement describing the adverse effects, if any, of an uncorrected nonconforming OBD system on the performance, fuel economy, or durability of the engine.

d. A statement that after remedial action has been taken, the manufacturer will have the service facility issue a certificate showing that the engine has been corrected under the recall program, and that such a certificate will be required to be provided to the Department of Motor Vehicles as a condition for vehicle registration.

(D) A notice sent pursuant to this section or any other communication sent to vehicle or engine owners or dealers may not contain any statement, expressed or implied, that the OBD system is compliant or that the OBD system will not degrade air quality.

(E) The Executive Officer shall inform the manufacturer of any other requirements pertaining to the notification under section (e)(3) which the Executive Officer has determined as reasonable and necessary to assure the effectiveness of the recall campaign.

(4) *Label Indicating that Recall Repairs Have Been Performed.*

(A) If the required remedial action involves recall of engine family(ies), OBD group(s), or subgroup(s) thereof, the manufacturer shall require those who perform inspections and/or recall repairs to affix a label to each vehicle that has been inspected and/or repaired.

(B) The label must be placed in a location approved by the Executive Officer and must be fabricated of a material suitable for such location in which it is installed and which is not readily removable.

(C) The label must contain the remedial action campaign number and a code designating the facility at which the remedial action or inspection to determine the need for remedial action was performed.

(5) *Proof of Performance of Remedial Action Certificate.*

If the required remedial action involves a recall, the manufacturer shall provide, through its service agents, to owners of vehicles or engines that have had the remedial action performed a certificate that confirms that the engine has been recalled and that required inspection and/or repairs have been performed. The Executive Officer shall prescribe a format for the certificate, which shall be consistent with the format required in Cal. Code Regs., title 13, section 2117 and section 2129.

(6) *Record Keeping and Reporting Requirements.*

(A) The manufacturer shall maintain sufficient records to enable the Executive Officer to conduct an analysis of the adequacy of the remedial action.

(B) Unless otherwise specified by the Executive Officer, the manufacturer shall report on the progress of the remedial action campaign by submitting reports for eight consecutive quarters commencing with the quarter immediately after the recall campaign begins. The reports shall be submitted no later than 25 days after the close of each calendar quarter to: Chief, Emissions Certification and Compliance Division, 4001 Iowa Avenue, Riverside, California 92507. For each recall campaign, the quarterly report must contain the following:

(i) The engine family and the remedial action campaign number designated by the manufacturer and a brief description of the nature of the campaign.

(ii) The date owner notifications began and date completed.

(iii) The number of engines involved in the remedial action campaign.

(iv) The number of engines known or estimated to be equipped with the nonconforming OBD system and an explanation of the means by which this number was determined.

(v) The number of engines inspected during the campaign since its inception.

(vi) The number of engines found to be affected by the nonconformity during the campaign since its inception.

(vii) The number of engines receiving remedial action during the campaign since its inception.

(viii) The number of engines determined to be unavailable for inspection or remedial action, during the campaign since its inception, due to exportation, theft, scrapping, or other reasons (specify).

(ix) The number of engines, during the campaign since its inception, determined to be ineligible for remedial action under section (e)(2)(B).

(x) An initial list, using the following data elements and designated positions, indicating all vehicles or engines subject to recall that the manufacturer has not been invoiced for, or a subsequent list indicating all engines subject to the recall that the manufacturer has been invoiced for since the previous report. The list must be supplied in a standardized computer format to be specified by the Executive Officer. The data elements must be written in "ASCII" code without a comma separating each element. For example: XTY32A71234E-9456123408-25-91A. The add flag (see below) should reflect the vehicles or engines for which the manufacturer has not been invoiced and the delete flag should reflect changes since the previous report. The Executive Officer may change the frequency or format of this submittal depending on the needs of enforcement. The Executive Officer may not, however, require a frequency or format for this submittal that is different in any way from the frequency or format determined by the Executive Officer as required for reporting of data in Cal. Code Regs., title 13, section 2119(a)(10) and section 2133(a)(10).

Data Elements	Positions
• File Code (designated by DMV)	1
• License Plate Number	2-8
• Last three VIN positions	9-11
• Recall ID Number	12-17
• Mfg. ID Number (Mfg. Occupational License Number)	18-22
• Recall Start Date (mmddyyyy)	23-30
• Add or Delete Flag (A/D)	31
• Complete VIN if personalized license plate (File Code "L" or "S")	32-48

(xi) A copy of any service bulletins issued during the reporting period by the manufacturer to franchised dealerships or other service agents that relate to the nonconforming OBD system and the remedial action and have not previously been reported to the Executive Officer.

(xii) A copy of all communications transmitted to vehicle or engine owners that relate to the nonconforming OBD systems and the required remedial action and have not been previously reported to the Executive Officer.

(C) If the manufacturer determines that any of the information submitted to the Executive Officer pursuant to section (e) has changed or is incorrect, the manufacturer shall submit the revised information, with an explanation.

(D) The manufacturer shall maintain in a form suitable for inspection, such as computer information, storage devices, or card files, and shall make available to the Executive Officer or his or her authorized representative upon request, the names and addresses of vehicle or engine owners:

(i) To whom notification was sent;

(ii) Whose engines were repaired or inspected under the recall campaign;

(iii) Whose engines were determined not to be eligible for remedial action because the engines were modified, altered, or unavailable due to exportation, theft, scrapping, or other reason specified in the answer to sections (e)(6)(B)(viii) and (ix).

(E) The information gathered by the manufacturer to compile the reports required by these procedures must be retained for no less than one year beyond when engines within the engine class, on average, exceed the defined full useful life of the engines and must be made available to authorized personnel of ARB upon request.

(F) The filing of any report under the provisions of these procedures must not affect the manufacturer's responsibility to file reports or applications, obtain approval, or give notice under any other provisions of law.

(7) *Extension of Time.*

Upon request of the manufacturer, the Executive Officer may extend any deadline set forth in section 1971.5.1(e) upon finding that the manufacturer has demonstrated good cause for the requested extension.

(f) *Penalties for Failing to Comply with the Requirements of Section (e).*

(1) In addition to the penalties that may be assessed by the Executive Officer pursuant to section (d) because of a manufacturer's failure to comply with the requirements of Cal. Code Regs., title 13, section 1971.1.1, a manufacturer may be subject to penalties pursuant to section 43016, Health and Safety Code for failing to comply with the requirements of section (e).

(2) If a manufacturer fails to comply with a voluntary or influenced remedial action plan, the Executive Officer may order remedial action pursuant to section (d) above.

NOTE: Authority cited: Sections 39010, 39600, 39601, 43000.5, 43013, 43016, 43018, 43100, 43101, 43104, 43105, 43105.5, 43106, 43154, 43211, and 43212, Health and Safety Code. Reference: Sections 39002, 39003, 39010, 39018, 39021.5, 39024, 39024.5, 39027, 39027.3, 39028, 39029, 39031, 39032, 39032.5, 39033, 39035, 39037.05, 39037.5, 39038, 39039, 39040, 39042, 39042.5, 39046, 39047, 39053, 39054, 39058, 39059, 39060, 39515, 39600, 39601, 43000, 43000.5, 43004, 43006, 43013, 43016, 43018, 43100, 43101, 43102, 43104, 43105, 43105.5, 43106, 43150, 43151, 43152, 43153, 43154, 43155, 43156, 43204, 43211, and 43212, Health and Safety Code.

§ 2035.0.1. Purpose, Applicability, and Definitions (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) Purpose.

The purpose of this article is to interpret and make specific the statutory emissions warranty set forth in Health and Safety Code sections 43205, and 43205.5 by clarifying the rights and responsibilities of individual motor vehicle and motor vehicle engine owners, motor vehicle and motor vehicle engine manufacturers, and the service industry.

(b) Applicability.

This article shall apply to:

(1) California-certified 1979 and subsequent model motorcycles, passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty vehicles, registered in California, regardless of their original point of registration; and

(2) California certified motor vehicle engines used in such vehicles.

(c) Definitions. For the purposes of this article, the following definitions shall apply:

(1) "Warrantable condition" means any condition of a vehicle or engine which triggers the responsibility of the manufacturer to take corrective action pursuant to sections 2036, 2037, or 2038.

(2) "Warranted Part" means:

(A) in the case of 1979 through 1989 model year passenger cars, light duty trucks, and medium-duty vehicles, 1979 and later model year motorcycles and heavy-duty vehicles, and 1990 and subsequent model year passenger cars, light-duty trucks, and medium duty vehicles produced before January 24, 1991, any emission-related part installed on a motor vehicle or motor vehicle engine by the vehicle or engine manufacturer, or installed in a warranty repair, which is included on the "Emissions Warranty Parts List" required by section 2036(f) and approved for the vehicle or engine by the Executive Officer; and

(B) in the case of 1990 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles other than those identified in subparagraph (A) of this definition, any part installed on a motor vehicle or motor vehicle engine by the vehicle or engine manufacturer, or installed in

a warranty repair, which affects any regulated emission from a motor vehicle or engine which is subject to California emission standards.

(3) "Warranty period" means the period of time and mileage that the vehicle, engine, or part are covered by the warranty provisions.

(4) "Warranty station" means a service facility authorized by the vehicle or engine manufacturer to perform warranty repairs. This shall include all of the manufacturer's dealerships which are franchised to service the subject vehicles or engines.

(5) "Vehicle or engine manufacturer" means the manufacturer granted certification for a motor vehicle or motor vehicle engine. In the case of motor vehicles for which certification of the exhaust and evaporative emissions control systems is granted to different manufacturers, the warranty responsibility shall be assigned accordingly.

NOTE: Authority cited: Sections 39600 and 39601, Health and Safety Code. Reference: Sections 43106, 43204, 43205, and 43205.5, Health and Safety Code.

§ 2036.0.1 Defects Warranty Requirements for 1979 Through 1989 Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles; 1979 and Subsequent Model Motorcycles and Heavy-Duty Vehicles; and Motor Vehicle Engines Used in Such Vehicles. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) Applicability.

This section shall apply to 1979 through 1989 model passenger cars, light-duty trucks, and medium-duty vehicles; 1979 and subsequent model motorcycles and heavy-duty vehicles; and motor vehicle engines used in such vehicles. The warranty period shall begin on the date the vehicle is delivered to an ultimate purchaser, or if the vehicle is first placed in service as a "demonstrator" or "company" car prior to delivery, on the date it is first placed in service.

(b) General Emissions Warranty Coverage.

The manufacturer of each motor vehicle or motor vehicle engine shall warrant to the ultimate purchaser and each subsequent purchaser that the vehicle or engine is:

(1) Designed, built, and equipped so as to conform, at the time of sale, with all applicable regulations adopted by the Air Resources Board pursuant to its authority in chapters 1 and 2, part 5, division 26 of the Health and Safety Code; and

(2) Free from defects in materials and workmanship which cause the failure of a warranted part to be identical in all material respects to that part as described in the vehicle or engine manufacturer's application for certification.

(c) Warranty Period.

The warranty period applicable to this section shall be:

(1) In the case of Class I motorcycles and motorcycle engines (50 to 169 cc or 3.1 to 10.4 cu. in.), a period of use of five years or 12,000 kilometers (7,456 miles), whichever first occurs.

(2) In the case of Class II motorcycles and motorcycle engines (170 to 279 cc or 10.4 to 17.1 cu. in.), a period of use of five years or 18,000 kilometers (11,185 miles), whichever first occurs.

(3) In the case of Class III motorcycles and motorcycle engines (280 cc and larger or 17.1 cu. in. and larger), a period of use of five years or 30,000 kilometers (18,641 miles), whichever first occurs.

(4) In the case of diesel-powered heavy-duty vehicles (except medium-duty vehicles), and motor vehicle engines used in such vehicles, a period of use of five years, 100,000 miles, or 3000 hours of operations, whichever first occurs. However, in no case may this period be less than the basic mechanical warranty that the manufacturer provides (with or without additional charge) to the purchaser of the engine. Extended warranties on select parts do not extend the emissions warranty requirements for the entire engine but only for those parts. In cases where responsibility for an extended warranty is shared between the owner and the manufacturer, the emissions warranty shall also be shared in the same manner as specified in the warranty agreement.

(5) In the case of passenger cars, light-duty trucks, and medium-duty vehicles certified under the optional 100,000-mile certification procedure, and motor vehicle engines used in such vehicles, a period of use of ten years or 100,000 miles, whichever first occurs, except as otherwise provided in this paragraph. In the case of diesel particulate control system components on the 1985 and subsequent model passenger cars, light duty trucks, and medium-duty vehicles certified under the optional 100,000-mile certification procedure, the warranty period means five years or 50,000 miles, whichever first occurs, for failures of such components which do not result in the failure of any other warranted part to perform as designed during the warranty period of the vehicle, and ten years or 100,000 miles, whichever first occurs, for all other failures.

(6) In the case of vehicles certified to the optional emission standards pursuant to Health and Safety Code section 43101.5(a), which are sold on or after January 1, 1983, for fuel metering and ignition components contained in the state board's "Emissions Warranty Parts List", dated December 14, 1978, as amended February 22, 1985, a period of use of two years or 24,000 miles, whichever first occurs, and for all other warranted parts, a period of use of five years or 50,000 miles, whichever first occurs.

(7) In the case of all other passenger cars, light-duty trucks, and medium-duty vehicles, a period of use of five years or 50,000 miles, which ever first occurs.

(8) In the case of heavy-duty vehicles and motor vehicle engines used in such vehicles, (except for diesel-powered heavy-duty vehicles or all medium-duty vehicles, and motor vehicle engines used in such vehicles,) a period of use of five years or 50,000 miles, whichever first occurs. However, in no case may this period be less than the basic mechanical warranty period that the manufacturer provides (with or without additional charge) to the purchaser of the engine. Extended warranties on select parts do not extend the emissions warranty requirements for the entire engine but only for those parts. In cases where responsibility for an

extended warranty is shared between the owner and the manufacturer, the emissions warranty shall also be shared in the same manner as specified in the warranty agreement.

(d) Subject to the conditions and exclusions of subsection (j), the warranty on emissions-related parts shall function as follows:

(1) Any warranted part which is not scheduled for replacement as required maintenance in the written instructions required by subsection (e) shall be warranted for the warranty period defined in subsection (c). If any such part fails during the warranty period, it shall be repaired or replaced by the vehicle or engine manufacturer according to subsection (4) below. Any such part repaired or replaced under warranty shall be warranted for the remaining warranty period.

(2) Any warranted part which is scheduled only for regular inspection in the written instructions required by subsection (e) shall be warranted for the warranty period defined in subsection (c). A statement in such written instructions to the effect of "repair or replace as necessary" shall not reduce the period of warranty coverage. Any such part repaired or replaced under warranty shall be warranted for the remaining warranty period.

(3) Any warranted part which is scheduled for replacement as required maintenance in the written instructions required by subsection (e) shall be warranted for the period of time or mileage, whichever first occurs, prior to the first scheduled replacement point for that part. If the part fails before the first scheduled replacement point, the part shall be repaired or replaced by the vehicle or engine manufacturer according to subsection (4) below. Any such part repaired or replaced under warranty shall be warranted for the remainder of the period prior to the first scheduled replacement point for the part.

(4) Repair or replacement of any warranted part under the warranty provisions of this article shall be performed at no charge to the vehicle or engine owner, at a warranty station, except in the case of an emergency when a warranted part or a warranty station is not reasonably available to the vehicle or engine owner. In an emergency, repairs may be performed at any available service establishment, or by the owner, using any replacement part. The manufacturer shall reimburse the owner for his or her expenses including diagnostic charges for such emergency repair or replacement, not to exceed the manufacturer's suggested retail price for all warranted parts replaced and labor charges based on the manufacturer's recommended time allowance for the warranty repair and the geographically appropriate hourly labor rate. Heavy-duty vehicle and engine manufacturers shall establish reasonable emergency repair procedures which may differ from those specified in this subsection. A vehicle or engine owner may reasonably be required to keep receipts and failed parts in order to receive compensation for warranted repairs reimbursable due to an emergency, provided the manufacturer's written instructions advise the owner of his obligation.

(5) Notwithstanding the provisions of subsection (4), warranty services or repairs shall be provided at all of a manufacturer's dealership which are franchised to service the subject vehicles or engines.

(6) The vehicle or engine owner shall not be charged for diagnostic labor which leads to the determination that a warranted part is in fact defective, provided that such diagnostic work is performed at a warranty station.

(7) The vehicle or engine manufacturer shall be liable for damages to other vehicle components proximately caused by a failure under warranty any warranted part.

(8) Throughout the vehicle or engine's warranty period defined in subsection (b), the vehicle or engine manufacturer shall maintain a supply of warranted parts sufficient to meet the expected demand for such parts. The lack of availability of such parts or the incompleteness of repairs within a reasonable time period, not to exceed 30 days from the time the vehicle or engine is initially presented to the warranty station for repair, shall constitute an emergency for purposes of subsection (4).

(9) Any replacement part may be used in the performance of any maintenance or repairs. Any replacement part designated by a manufacturer may be used in warranty repairs provided without charge to the vehicle owner. Such use shall not reduce the warranty obligations of the vehicle or engine manufacturer, except that the vehicle or engine manufacturer shall not be liable under this article for repair or replacement of any replacement part which is not a warranted part (except as provided under subsection (7)).

(10) Any add-on or modified part exempted by the Air Resources Board from the prohibitions of Vehicle Code section 27156 may be used on a vehicle or engine. Such use, in and of itself, shall not be grounds for disallowing a warranty claim made in accordance with this article. The vehicle or engine manufacturer shall not be liable under this article to warrant failures of warranted parts caused by the use of an add-on or modified part.

(11) The Executive Officer may request and, in such case, the vehicle or engine manufacturer shall provide, any documents which describe that manufacturer's warranty procedures or policies.

(e) Commencing with 1980 models sold on or after September 1, 1979, each manufacturer shall furnish with each new vehicle or engine written instructions for the maintenance and use of the vehicle or engine by the owner, which instructions shall be consistent with this article and applicable regulations in article 2 of this subchapter.

(f) Commencing with 1980 models sold on or after September 1, 1979, each manufacturer shall furnish with each new vehicle or engine a list of the warranted parts installed on that vehicle or engine. The list shall include those parts included on the Air Resources Board "Emissions Warranty Parts List," dated December 14, 1978, as amended on February 22, 1985, and incorporated herein by reference.

(g) Except for 1980 and 1981 model motorcycles, each manufacturer shall submit the documents required by sections (e) and (f), with the manufacturer's preliminary application for new vehicle or engine certification for approval by the Executive Officer. The Executive Officer may reject or require modification of the manufacturer's list of warranted parts to ensure that each such list is of proper scope and also may reject or require modification of any of the documents required by subsection (e). Approval by the Executive Officer of the documents required by subsections (e) and (f), shall be a condition of certification. The Executive Officer shall approve or disapprove the documents required by subsections (e) and (f), within 90 days of the date such documents are received from the manufacturer. Any disapproval shall be accompanied by a statement of the reasons therefore. In the event of disapproval, the manufacturer may petition the Board to review the decision of the Executive Officer.

(h) Notwithstanding subsection (f), the Executive Officer may delete any part from a manufacturer's list of warranted parts provided in the manufacturer demonstrates to the Executive Officer's satisfaction that:

(1) Failure of such part will not increase the emissions of any vehicle or engine on which it is installed, and

(2) Any deterioration of driveability or performance which results from failure of the part could not be corrected by adjustments or modifications to other vehicle components.

(i) Vehicle Inspection Program.

This subsection shall apply to passenger cars, light-duty trucks, medium-duty and heavy-duty vehicles and motorcycles required to be inspected pursuant to any California statutorily authorized motor vehicle emissions inspection and maintenance program. The provisions of this section shall be contained in the warranty statement required pursuant to section 2039.

(1) The owner of a vehicle which fails the inspection during its warranty period may choose to have the vehicle repaired at a warranty station.

(A) If the warranty station identifies that the inspection failure was caused by the failure or malfunction of a warranted part, than the vehicle manufacturer shall be liable for expenses involved in detecting and correcting the part failure or malfunction, unless the warranty station demonstrates that the part failure or malfunction was caused by abuse,

neglect, or improper maintenance as specified in subsection (j)(1), or was caused by an adjustment not covered by warranty as specified in subsection (j)(2).

(B) If the warranty station demonstrates that the inspection failure was caused by one or more conditions executed from warranty coverage pursuant to subsection (j), the vehicle owner shall be liable for all diagnostic and repair expenses. Such expenses shall not exceed the maximum repair costs permissible under the inspection program.

(C) If the warranty station identifies that the inspection failure was caused by one or more defects covered under warranty pursuant to these regulations and in combination with one or more conditions excluded from warranty coverage pursuant to subsection (j), than the vehicle owner shall not be charged for the diagnostic and repair costs related to detecting and repairing the warrantable defects.

(2) In the alternative, the owner of a vehicle which fails an inspection may choose to have the vehicle repaired at other than a warranty station. If a warrantable defect is found, the vehicle owner may deliver the vehicle to a warranty station and have the defect corrected free of charge. The vehicle manufacturer shall not be liable for any expenses incurred at a service establishment not authorized to perform warranty repairs, except in the case of an emergency as specified in subsection (d)(4). If the vehicle owner chooses to have the warrantable defect repaired at other than a warranty station, the upper cost limit pursuant to Health and Safety Code section 44017 shall not apply to the repair.

(j) Exclusions.

(1) The repair or replacement of any warranted part otherwise eligible for warranty coverage under subsection (d) or (i), shall be excluded for such warranty coverage if the vehicle or engine manufacturer demonstrates that the vehicle or engine has been abused, neglected, or improperly maintained, and that such abuse, neglect, or improper maintenance was the direct cause of the need for the repair or replacement of the part.

(2) The following adjustments to warranted parts are excluded from warranty coverage under subsection (d) or (i); the idle air/fuel mixture ratio (for 1979 model passenger cars, and 1979 and 1980 model light-duty trucks and medium-duty vehicles), curb or high idle speed, ignition timing, valve lash, injection timing for diesel-powered vehicles, or any combination thereof.

(3) Except as provided in subsection (1) above, any adjustment of a component which as a factory installed, and properly operating, adjustment limiting device (such as an idle limiter cap) is eligible for warranty coverage under subsection (d) or (i).

NOTE: Authority cited: Sections 39600 and 39601, Health and Safety Code. Reference: Sections 43106, 43204, 43205.5, 44004, 44010, 44011, 44012, 44015, and 44017, Health and Safety Code.

§ 2040.0.1. Vehicle Owner Obligations. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) The owner of any vehicle or engine warranted pursuant to this article shall be responsible for the performance of all required scheduled maintenance specified in the written instructions furnished to the owner pursuant to subsections 2036 (e), 2037(e), and 2038(c)(1). Such maintenance may be performed by the owner, at a service establishment of the owner's choosing, or by a person or persons of the owner's choosing.

(b) Except as specified in subsections 2036(j)(l), 2037(i), and 2038(c), failure of the vehicle or engine owner to ensure the performance of such scheduled maintenance or to keep maintenance records shall not, per se, be grounds for disallowing a warranty claim.

NOTE: Authority cited: Sections 39600 and 39601, Health and Safety Code. Reference: Sections 43106. 43204, 43205, and 43205.5, Health and Safety Code.

§ 2111.0.1. Applicability. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) These procedures shall apply to:

(1) California-certified 1982 through the 2009 model-year passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles, motorcycles, and California-certified 1997 and subsequent model-year off-road motorcycles and all-terrain vehicles, and 2007 and subsequent model-year off-road sport vehicles, off-road utility vehicles, and sand cars, including those federally certified vehicles which are sold in California pursuant to Health and Safety Code section 43102,

(2) California-certified motor vehicle engines used in such vehicles,

(3) California-certified 2000 and subsequent model-year off-road compression-ignition engines, and

(4) California-certified 2009 and subsequent model-year spark-ignition inboard and sterndrive marine engines complying with the Option 1 requirements in Section 2442(b)(l) and California-certified 2008 and subsequent model-year spark-ignition inboard and sterndrive marine engines complying with the Option 2 requirements in Section 2442(b)(1).

(b) These procedures shall not apply to zero emission vehicles and those vehicles certified under Health and Safety Code section 44201.

(c) The Executive Officer may waive any or all of the requirements of these procedures if he or she determines that the requirement constitutes an unwarranted burden on the manufacturer without a corresponding emission reduction.

NOTE: Authority cited: Sections 39600, 39601,43013,43018,43105 and 43106, Health and Safety Code. Reference: Sections 43000, 43009.5, 43013, 43018, 43101,43104,43105,43106,43107 and 43204-43205.5, Health and Safety Code.

§ 2113.0.1. Initiation and Approval of Voluntary and Influenced Emission-Related Recalls. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) When any manufacturer initiates a voluntary emission recall campaign, the manufacturer shall notify the Executive Officer of the recall at least 30 days before owner notification is to begin. The manufacturer shall also submit a voluntary recall plan for approval, as prescribed under Section 2114 of these procedures. A voluntary recall plan shall be deemed approved unless disapproved by the Executive Officer within 20 days after receipt of the recall plan.

(b) When any manufacturer, based on enforcement test results or any other information provided or required by the ARB, proposes to initiate an influenced emission recall campaign, the manufacturer shall submit for approval by the Executive Officer an influenced emission recall plan as prescribed by Section 2114 of these procedures. The plan shall be submitted within 45 days following the receipt of a notification from the ARB that enforcement test results or other information demonstrate a vehicle or an engine noncompliance.

(c) The Executive Officer shall approve the recall plan if the plan contains the information specified in Section 2114 and is designed to notify the vehicle owner and correct the nonconformity in an expeditious manner. Notification of vehicle or engine owners and the implementation of recall repairs shall commence no later than the schedule specified under Section 2114(a)(3) and (4), unless the manufacturer can show good cause for the Executive Officer to extend the deadline.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2114.0.1. Voluntary and Influenced Recall Plans. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) The recall plan for both voluntary and influenced recalls shall contain the following information unless otherwise specified:

(1) A description of each class or category of vehicle or engine subject to recall including the number of vehicles or engines to be recalled, the engine family, test group or a subgroup thereof, the model year, the make, the model, and such other information as may be required to identify the vehicles or engines to be recalled.

(2) A description of the nonconformity and the specific modifications, alterations, repairs, adjustments, or other changes to be made to correct the vehicles or engines.

(3) A description of the method by which the manufacturer will determine the names and addresses of vehicle or engine owners and the manufacturer's method and schedule for notifying the service facilities and vehicle or engine owners of the recall.

(4) A description of the procedure to be followed by vehicle or engine owners to obtain correction of the nonconformity. This shall include the date on or after which the owner can have the nonconformity remedied, the time reasonably necessary to perform the labor to remedy the nonconformity, and the designation of facilities at which the nonconformity can be remedied.

(5) If some or all of the nonconforming vehicles or engines are to be remedied by persons other than dealers or authorized warranty agents of the manufacturer, a description of such class of persons.

(6) A copy of the letter of notification to be sent to vehicle or engine owners.

(7) A description of the system by which the manufacturer will assure that an adequate supply of parts will be available to perform the repair under the recall plan, including the date by which an adequate supply of parts will be available to initiate the repair campaign, and the method to be used to assure the supply remains both adequate and responsive to owner demand.

(8) A copy of all necessary instructions to be sent to those persons who are to perform the repair.

(9) A description of the impact of the proposed repairs or adjustments on fuel economy, driveability, performance and safety of each class or category of vehicles or engines to be recalled and a brief summary of the data, technical studies, or engineering evaluations which support these descriptions.

(10) Under an influenced recall, an estimate of the capture rate from the proposed recall derived from actual data and/or manufacturer experience. A 60 percent capture rate shall be assigned for recalls based exclusively on noncompliance as defined in Section 2112(h)(1), above.

(11) Under an influenced recall based on noncompliance as defined in Section 2112(h)(2), above, a description of the impact of the proposed changes on the average emissions from the vehicles or engines to be recalled. The description shall contain the following:

(A) Average noncompliance emission levels.

(B) Average emission reduction per pollutant resulting from the recall repair. These averages shall be verified by the manufacturer by applying the proposed recall repairs to two or more in-use vehicles or engines representing the average noncompliance emission levels. Only those vehicles or engines with baseline-emission levels within 25 percent of the average emission levels of noncomplying pollutant(s) established under the in-use enforcement test program may be used by manufacturers to verify proposed recall repairs. The Executive Officer may allow the use of vehicles or engines exceeding these limits if none which meet the limits can be reasonably procured. In the case of heavy-duty engines, the average emission levels may be verified using laboratory engines, subject to approval by the Executive Officer.

(C) An estimate of the average emission level per pollutant for the class or category of vehicles or engines after repair as corrected by the estimated capture rate. The estimated average emission level shall comply with the applicable emission standard. The Executive Officer may waive the requirement for average emission compliance with the standards provided the emission level per vehicle repaired is reduced to its new-vehicle certification emission level at a minimum capture rate of 60 percent.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2115.0.1. Eligibility for Repair. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

The manufacturer shall not condition eligibility for repair on the proper maintenance or use of the vehicle except for strong and compelling reasons and with the approval of the Executive Officer; however, the manufacturer shall not be obligated to repair a component which has been removed or altered so that the remedial action cannot be performed without additional cost.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2116.0.1. Repair Label. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) The manufacturer shall require those who perform the repair to affix a label to each vehicle or engine repaired, or, when required, inspected, under the voluntary or influenced recall plan.

(b) The label shall be placed in a location approved by the Executive Officer and shall be fabricated of a material suitable for such location in which it is installed and which is not readily removable.

(c) The label shall contain the recall campaign number and a code designating the campaign facility at which the repair, or inspection for repair, was performed.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2117.0.1. Proof of Correction Certificate. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

The manufacturer shall require those who perform the repair to provide the owner for each vehicle or engine repaired with a certificate, in a format prescribed by the Executive Officer, which indicates that the noncomplying vehicle or engine has been corrected under the recall program. This requirement shall become effective and applicable upon the effective date of a recall enforcement program adopted by the Department of Motor Vehicles or another state agency which requires presentation of proof of correction of a recalled vehicle prior to issuance of a smog certificate, registration renewal, or other entitlement to use.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2118.0.1. Notification. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

The notification of vehicle or engine owners shall contain the following:

(a) The statement: "Your (vehicle or engine) (is or may be) releasing air pollutants which exceed (California or California and federal) standards," if applicable as determined by the Executive Officer.

(b) A statement that the nonconformity of any such vehicles or engines will be remedied at the expense of the manufacturer.

(c) A statement that such nonconformity if not repaired may cause the vehicle or engine to fail a vehicle inspection or Smog Check test when such tests are required under state law.

(d) A statement describing the adverse effect, if any, of the uncorrected nonconformity on the performance, fuel economy, or durability of the vehicle or engine.

(e) After the effective date of the recall enforcement program referred to in Section 2117, a statement that a certificate showing that the vehicle has been repaired under the recall program shall be issued by the service facilities, and that such a certificate will be required as a condition of vehicle registration or operation, as appropriate.

(f) A card to be used by a vehicle or engine owner in the event the vehicle or engine to be recalled has been sold. Such card should be addressed to the manufacturer, have postage paid, and shall provide a space in which the owner may indicate the name and address of the person to whom the vehicle or engine was sold or transferred.

(g) The statement: "In order to ensure your full protection under the emission warranty provisions, it is recommended that you have your (vehicle or engine) serviced as soon as possible. Failure to do so could be determined as lack of proper maintenance of your (vehicle or engine)." This statement is not required for off-road motorcycles or all-terrain vehicles.

(h) A telephone number provided by the manufacturer, which may be used to report difficulty in obtaining recall repairs.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2119.0.1. Recordkeeping and Reporting Requirements. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) Unless otherwise specified by the Executive Officer, the manufacturer shall report on the progress of the recall campaign by submitting subsequent reports for six consecutive quarters commencing with the quarter after the recall campaign begins. Such reports shall be submitted no later than 25 days after the close of each calendar quarter to: Chief, Emissions Certification and Compliance Division, 4001 Iowa Ave, Riverside, CA 92507. For each class or category of vehicle or engine subject to the emission recall campaign, the quarterly report shall contain the following:

(1) Engine family or test group and emission recall campaign number designated by the manufacturer.

(2) Date owner notification was begun, and date completed.

(3) Number of vehicles or engines involved in the voluntary or influenced emission recall campaign.

(4) Number of vehicles or engines known or estimated to be affected by the nonconformity and an explanation of the means by which this number was determined.

(5) Number of vehicles or engines inspected pursuant to the voluntary or influenced emission recall plan.

(6) Number of inspected vehicles or engines found to be affected by the nonconformity.

(7) Number of vehicles or engines receiving repair under the recall plan.

(8) Number of vehicles or engines determined to be unavailable for inspection or repair under the recall plan due to exportation, theft, scrapping, or for other reasons (specify).

(9) Number of vehicles or engines determined to be ineligible for recall action due to removed or altered components.

(10) A listing of the identification numbers of vehicles or engines subject to recall but for whose repair the manufacturer has not been invoiced. This listing shall be supplied in a standardized computer data storage device to be specified by the

Executive Officer. The frequency of this submittal may be changed by the Executive Officer depending on the needs of recall enforcement.

(11) A copy of any service bulletins transmitted to dealers or other authorized repair facilities which relate to the nonconformity to be corrected and which have not previously been reported.

(12) A copy of all communications transmitted to vehicle or engine owners which relate to the nonconformity and which have not previously been submitted.

(b) If the manufacturer determines that any of the information submitted to the Executive Officer pursuant to (a) above has changed or was incorrect, revised information and an explanatory note shall be submitted. Responses to subsections (a)(5), (6), (7), (8), and (9) above shall be cumulative totals.

(c) The manufacturer shall maintain in a form suitable for inspection, such as computer information storage devices or card files, and shall make available to the Executive Officer or his or her authorized representative upon request, the names and addresses of vehicle or engine owners:

(1) To whom notification was given;

(2) Whose vehicles were repaired or inspected under the recall plan; and

(3) Who were determined not to qualify for such recall action due to removed or altered components.

(d) The information gathered by the manufacturer to compile the reports required by these procedures shall be retained for not less than one year beyond the useful life of the vehicles or engines and shall be made available to authorized personnel of the Air Resources Board upon request.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2121.0.1. Penalties. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

Under the influenced recall, failure by a manufacturer to notify the vehicle or engine owners and repair the vehicles or engines in the manner specified in the plan shall constitute a violation of the Executive Officer's order approving the plan and a violation of Health and Safety Code Section 43105. Notwithstanding the above, no penalty shall be imposed for a manufacturer's failure to meet the estimated capture rate except for an influenced recall when the 60-percent capture rate is required pursuant to Section 2114(a)(10) above, in which case a recall pursuant to Section 2123 below may be ordered if the Executive Officer determines that the manufacturer did not show a good faith effort to achieve the capture rate set forth in the recall plan.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2123.0.1. Initiation and Notification of Ordered Emission-Related Recalls. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) A manufacturer shall be notified whenever the Executive Officer has determined, based on warranty information reports, field information reports, enforcement testing results, or any other information, that a substantial number of a class or category of vehicles or engines produced by that manufacturer, although properly maintained and used, contain a failure in an emission-related component which, if uncorrected, may result in the vehicles' or engines' failure to meet applicable standards over their useful lives; or whenever a class or category of vehicles or engines within their useful lives, on average, do not conform to the standards prescribed pursuant to Section 43101 of the Health and Safety Code as applicable to the model year of such vehicles.

(b) It shall be presumed for purposes of this section that an emission-related failure will result in the exceedance of emission standards unless the manufacturer presents evidence in accordance with the procedures set forth in Title 13, California Code of Regulations, Section 2147 which demonstrates to the satisfaction of the Executive Officer that the failure will not result in exceedance of emission standards over the useful life of the vehicle or engine,

(c) The notification shall include a description of each class or category of vehicles or engines encompassed by the determination of nonconformity, shall set forth the factual basis for the determination and shall designate a date at least 45 days from the date of receipt of such notification by which the manufacturer shall submit a plan to remedy the nonconformity.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2125.0.1. Ordered Recall Plan. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) Unless a public hearing is requested by the manufacturer, a recall plan shall be submitted to the Chief, Emissions Certification and Compliance Division, 4001 Iowa Ave, Riverside, CA 92507, within the time limit specified in the notification. The Executive Officer may grant the manufacturer an extension upon good cause shown.

(b) The recall plan shall contain the following:

(1) A description of each class or category of vehicle or engine to be recalled, including the engine family or sub-group thereof, the model-year, the make, the model, and such other information as may be required to identify the vehicles or engines to be recalled.

(2) A description of the nonconformity and the specific modifications, alterations, repairs, corrections, adjustments or other changes to be made to bring the vehicles or engines into conformity including a brief summary of the data and technical studies which support the manufacturer's decision regarding the specific corrections to be made.

(3) A description of the method by which the manufacturer will determine the names and addresses of vehicle or engine owners and the method by which they will be notified.

(4) A description of the procedure to be followed by vehicle or engine owners to obtain correction of the nonconformity including the date on or after which the owner can have the nonconformity remedied, the time reasonably necessary to perform the labor required to correct the nonconformity, and the designation of facilities at which the nonconformity can be remedied. The repair shall be completed within a reasonable time designated by the Executive Officer from the date the owner delivers the vehicle or engine for repair. This requirement becomes applicable on the date designated by the manufacturer as the date on or after which the owner can have the nonconformity remedied.

(5) If some or all of the nonconforming vehicles or engines are to be remedied by persons other than dealers or authorized warranty agents of the manufacturer, a description of such class of persons and a statement indicating that the participating members of the class will be properly equipped to perform such remedial action.

(6) The capture rate required for each class or category of vehicle or engine to be recalled. Under recalls based on exceedance of emission standards, the capture rate shall be calculated using the following formula:

$$R = \frac{(Ef - Es) \times 100\%}{\Delta}$$

where: R = capture rate (see section 2112(a), above, for definition).

Δ = average reduction per vehicle resulting from the recall repair (see subsection (b)(12)(B), below, for determination).

Ef = average noncompliance emission level determined from in-use enforcement testing and other sources.

Es = emission standard for a particular pollutant.

An 80 percent capture rate shall be required for recalls based exclusively on noncompliance as defined in section 2112(h)(1), above.

(7) The plan may specify the maximum incentives (such as a tune-up or specified quantity of gasoline), if any, the manufacturer will offer to induce vehicle or engine owners to present their vehicles for repair, as evidence that the manufacturer has made a good faith effort to repair the percentage of vehicles or engines specified in the plan. The plan shall include a schedule for implementing actions to be taken including identified increments of progress towards implementation and deadlines for completing each such increment.

(8) A copy of the letter of notification to be sent to vehicle or engine owners.

(9) A description of the system by which the manufacturer will assure that an adequate supply of parts will be available to perform the repair under the recall plan including the date by which an adequate supply of parts will be available to initiate the repair campaign, and the method to be used to assure the supply remains both adequate and responsive to owner demand.

(10) A copy of all necessary instructions to be sent to those persons who are to perform the repair under the recall plan.

(11) A description of the impact of the proposed changes on fuel economy, driveability, performance and safety of each class or category of vehicles or engines to be recalled and a brief summary of the data, technical studies, or engineering evaluations which support these descriptions.

(12) A description of the impact of the proposed changes on the average emissions of the vehicles or engines to be recalled based on noncompliance as defined in section 2112(h)(2), above. The description shall contain the following:

(A) Average noncompliance emission levels.

(B) Average emission reduction or increase per pollutant resulting from the recall repair. These averages shall be verified by the manufacturer by applying the proposed recall repairs to two or more in-use vehicles or engines representing the average noncompliance emission levels. Only those vehicles or engines with baseline emission levels within 25 percent of the average emission levels of noncomplying pollutant(s) established under

the in-use enforcement test program may be used by manufacturers to verify proposed recall repairs. The Executive Officer may allow the use of vehicles or engines exceeding these limits if none which meet the limits can be reasonably procured. In the case of heavy-duty engines, the average emission levels may be verified by using laboratory engines, subject to approval by the Executive Officer.

(C) An estimate of the average emission level per pollutant for a class or category of vehicles or engines after repair as corrected by the required capture rate. The estimated average emission level shall comply with the applicable emission standards. If the average emissions levels achieved by applying the average emission reduction per vehicle or engine after repair and the estimated capture rate, do not achieve compliance with the emissions standards, a manufacturer shall propose other measures to achieve average emissions compliance.

(13) Any other information, reports, or data which the Executive Officer may reasonably determine to be necessary to evaluate the recall plan.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2126.0.1. Approval and Implementation of Recall Plan. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) If the Executive Officer finds that the recall plan is designed effectively to correct the nonconformity and complies with the provisions of Section 2125, he or she will so notify the manufacturer in writing. Upon receipt of the approval notice from the Executive Officer, the manufacturer shall commence implementation of the approved plan. Notification of vehicle or engine owners and the implementation of recall repairs shall commence within 45 days of the receipt of notice unless the manufacturer can show good cause for the Executive Officer to extend the deadline.

(b) If the Executive Officer does not approve the recall plan or the mitigation measures provided in Section 2130 as submitted, the Executive Officer shall order modification of the plan or mitigation measures with such changes and additions as he or she determines to be necessary. The Executive Officer shall notify the manufacturer in writing of the disapproval and the reasons for the disapproval.

(c) The manufacturer may contest the Executive Officer's disapproval by requesting a public hearing pursuant to the procedures set forth in Section 60055.1, Title 17, California Code of Regulations. As a result of the hearing, the Board may affirm, overturn or modify the Executive Officer's action. In its decision, affirming or modifying, the Board shall specify the date by which the manufacturer shall commence notifying vehicle or engine owners and implementing the required recall repairs.

(d) If no public hearing is requested in accordance with (c) above, the manufacturer shall incorporate the changes and additions required by the Executive Officer and shall commence notifying vehicle or engine owners and implementing the required recall repairs within 60 days of the manufacturer's receipt of the Executive Officer's disapproval.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

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§ 2127.0.1. Notification of Owners. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) Notification to vehicle or engine owners shall be made by first class mail or by such other means as approved by the Executive Officer provided, that for good cause, the Executive Officer may require the use of certified mail to ensure an effective notification.
(b) The manufacturer shall use all reasonable means necessary to locate vehicle or engine owners provided, that for good cause, the Executive Officer may require the manufacturer to use motor vehicle registration lists available from State or commercial sources to obtain the names and addresses of vehicle or engine owners to ensure effective notification.

(c) The Executive Officer may require subsequent notification by the manufacturer to vehicle or engine owners by first class mail or other reasonable means provided, that for good cause, the Executive Officer may require the use of certified mail to ensure effective notification.

(d) The notification of vehicle or engine owners shall contain the following:

(1) The statement: "the California Air Resources Board has determined that your (vehicle or engine) (is or may be) releasing air pollutants which exceed (California or California and Federal) standards. These standards were established to protect your health and welfare from the dangers of air pollution."

(2) A statement that the nonconformity of any such vehicles or engines will be remedied at the expense of the manufacturer.

(3) A statement that eligibility may not be denied solely on the basis that the vehicle or engine owner used parts not manufactured by the original equipment vehicle manufacturer, or had repairs performed by outlets other than the vehicle or engine manufacturer's franchised dealers.

(4) A clear description of the components which will be affected by the recall action and a general statement of the measures to be taken to correct the nonconformity.

(5) A statement that such nonconformity, if not repaired, may cause the vehicle or engine to fail an emission inspection or Smog Check test when such tests are required under State law.

(6) A description of the adverse effects, if any, that an uncorrected nonconformity would have on the performance, fuel economy, or driveability of the vehicle or engine or to the function of other engine components.

(7) A description of the procedure which the vehicle or engine owner should follow to obtain correction of the nonconformity including the date on or after which the

owner can have the nonconformity remedied, the time reasonably necessary to correct the nonconformity, and a designation of the facilities at which the nonconformity can be remedied.

(8) After the effective date of the recall enforcement program referred to in Section 2117, above, a statement that a certificate showing that the vehicle has been repaired under the recall program shall be issued by the service facilities and that such a certificate may be required as a condition of vehicle registration or operation, as applicable.

(9) A card to be used by a vehicle or engine owner in the event the vehicle or engine to be recalled has been sold. Such card should be addressed to the manufacturer, have postage paid, and shall provide a space in which the owner may indicate the name and address of the person to whom the vehicle or engine was sold.

(10) The statement: "In order to ensure your full protection under the emission warranty made applicable to your (vehicle or engine) by State or Federal law, and your right to participate in future recalls, it is recommended that you have your (vehicle or engine) serviced as soon as possible. Failure to do so could be determined to be a lack of proper maintenance of your (vehicle or engine)." This statement is not required for off-road motorcycles or all-terrain vehicles.

(11) A telephone number provided by the manufacturer, which may be used to report difficulty in obtaining recall repairs.

(e) The manufacturer shall not condition eligibility for repair on the proper maintenance or use of the vehicle except for strong or compelling reasons and with approval of the Executive Officer; however, the manufacturer shall not be obligated to repair a component which has been removed or altered so that the recall action cannot be performed without additional cost.

(f) No notice sent pursuant to Section 2125(b)(8), above, nor any other communication sent to vehicle or engine owners or dealers shall contain any statement, express or implied, that the nonconformity does not exist or will not degrade air quality.

(g) The manufacturer shall be informed of any other requirements pertaining to the notification under this section which the Executive Officer has determined are reasonable and necessary to ensure the effectiveness of the recall campaign.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2128.0.1. Repair Label. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) The manufacturer shall require those who perform the repair under the recall plan to affix a label to each vehicle or engine repaired or, when required, inspected under the recall plan.

(b) The label shall be placed in a location as approved by the Executive Officer and shall be fabricated of a material suitable for such location and which is not readily removable.

(c) The label shall contain the recall campaign number and a code designating the facility at which the repair, inspection for repair, was performed.

NOTE: Authority cited: Sections 39600, 39601, 43013. 43018 and 43105. Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104. 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2129.0.1. Proof of Correction Certificate. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

The manufacturer shall require those who perform the recall repair to provide the owner of each vehicle or engine repaired with a certificate, through a protocol and in a format prescribed by the Executive Officer, which indicates that the noncomplying vehicle or engine has been corrected under the recall program. This requirement shall become effective and applicable upon the effective date of the recall enforcement program referred to in Section 2117, above.

NOTE Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2130.0.1. Capture Rates and Alternative Measures. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

The manufacturer shall comply with the capture rate specified in the recall plan as determined pursuant to Section 2125(b)(6), above, within six consecutive quarters beginning with the quarter in which the notification of vehicle or engine owners was initiated. If, after good faith efforts, the manufacturer cannot correct the percentage of vehicles specified in the plan by the applicable deadlines and cannot take other measures to bring the engine family or test group into compliance with the standards, the manufacturer shall propose mitigation measures to offset the emissions of the unrepaired vehicles within 45 days from the last report filed pursuant to Section 2133(c), below. The Executive Officer shall approve such measures provided that:

(a) the emission reductions from the recalled and repaired vehicles or engines and the mitigation measures are equivalent to achieving the capture rate; and

(b) the emission reductions from the mitigation measures are real and verifiable; and

(c) the mitigation measures are implemented in a timely manner.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2131.0.1. Preliminary Tests. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

The Executive Officer may require the manufacturer to conduct tests on components and vehicles or engines incorporating a proposed correction, repair, or modification reasonably designed and necessary to demonstrate the effectiveness of the correction, repair, or modification.

NOTE: Authority cited: Sections 39600. 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2133.0.1. Recordkeeping and Reporting Requirements. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) The manufacturer shall maintain sufficient records to enable the Executive Officer to conduct an analysis of the adequacy of the recall campaign. The records shall include, for each class or category of vehicle or engine, but need not be limited to, the following:

(1) Engine family involved and recall campaign number as designated by the manufacturer.

(2) Date owner notification was begun, and date completed.

(3) Number of vehicles or engines involved in the recall campaign.

(4) Number of vehicles or engines known or estimated to be affected by the nonconformity.

(5) Number of vehicles or engines inspected pursuant to the recall plan and found to be affected by the nonconformity.

(6) Number of inspected vehicles or engines.

(7) Number of vehicles or engines receiving repair under the recall plan.

(8) Number of vehicles or engines determined to be unavailable for inspection or repair under the recall plan due to exportation, theft, scrap- ping, or for other reasons (specify).

(9) Number of vehicles or engines determined to be ineligible for recall action due to removed or altered components.

(10) A listing of the identification numbers of vehicles or engines subject to recall but for whose repair the manufacturer has not been invoiced. This listing shall be supplied in a standardized computer data storage device to be specified by the Executive Officer. The frequency of this submittal as specified in subsection (c) below, may be changed by the Executive Officer depending on the needs of recall enforcement.

(11) Any service bulletins transmitted to dealers which relate to the nonconformity and which have not previously been submitted.

(12) All communications transmitted to vehicle or engine owners which relate to the nonconformity and which have not previously been submitted.

(b) If the manufacturer determines that the original responses to subsections (a)(3) and (4) of these procedures are incorrect, revised figures and an explanatory note shall be submitted. Responses to subsections (a)(5), (6), (7), (8), and (9) shall be cumulative totals.

(c) Unless otherwise directed by the Executive Officer, the information specified in subsection (a) of these procedures shall be included in six quarterly reports, beginning with the quarter in which the notification of owners was initiated, or until all nonconforming vehicles or engines involved in the campaign have been remedied, whichever occurs sooner. Such reports shall be submitted no later than 25 days after the close of each calendar quarter.

(d) The manufacturer shall maintain in a form suitable for inspection, such as computer information storage devices or card files, and shall make available to the Executive Officer or his or her authorized representative upon request, lists of the names and addresses of vehicle or engine owners:

(1) To whom notification was given;

(2) Who received remedial repair or inspection under the recall plan; and

(3) Who were denied eligibility for repair due to removed or altered components.

(e) The records and reports required by these procedures shall be retained for not less than one year beyond the useful life of the vehicles or engines involved, or one year beyond the reporting time frame specified in subsection (c) above, whichever is later.

NOTE: Authority cited: Sections 39600, 39601. 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2137.0.1. Vehicle and Engine Selection. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) Any vehicle of an engine family, test group, any vehicle of a subgroup of an engine family or test group, or any engine used in a piece of equipment, manufactured for sale in California, shall be subject to these test procedures during its useful life. A minimum of ten (10) in-use vehicles or engines determined by the CARB to be properly maintained and used will be procured and tested by the CARB or its designated laboratory to represent the emission characteristics of the engine family, test group or subgroup. The CARB may test less than ten (10) in-use vehicles or engines if the manufacturer notifies the CARB in writing that the manufacturer will accept the results from less than ten (10) vehicles or engines as being representative of the engine family, test group or subgroup

(b) No vehicle or engine shall be accepted by the CARB as a representative vehicle or engine for enforcement testing unless the following criteria are met:

(1) California certified and registered.

(2) Odometer indication of less than certified useful-life mileage and vehicle age within useful-life time period.

(3) No indication of abuse (e.g., racing, overloading, misfueling, or other misuse), neglect, improper maintenance or other factors that would have a permanent effect on emission performance.

(4) No major repair to engine or major repair of vehicle resulting from collision.

(5) No indication of any problem that might jeopardize the safety of laboratory personnel.

(6) For off-road compression-ignition engines subject to recall testing, engines shall have an hour meter indication and engine age not exceeding the following periods:

(A) For all engines rated under 19 kilowatts, and for constant-speed engines rated under 37 kilowatts with rated speeds greater than or equal to 3,000 revolutions per minute, four years or 2.250 hours of operation, whichever first occurs.

(B) For all other engines rated above 19 kilowatts and under 37 kilowatts, five years or 3,750 hours of operation, whichever first occurs.

(C) For all engines rated at or above 37 kilowatts, seven years or 6,000 hours of operation, whichever first occurs.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Health and Safety Code Sections 43000, 43009.5, 43013. 43018. 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

§ 2141.0.1. General Provisions. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) The provisions regarding applicability of the failure reporting procedures and the definitions shall be the same as those set forth in Title 13, California Code of Regulations, Sections 2111 and 2112, except that this Section 2141 does not apply to off-road compression-ignition engines, as defined in Section 2421. The provisions of this Article shall apply to the vehicles and engines specified in section 2111 manufactured up to and including the 2009 model year, plus their useful lives. This Article shall not apply to vehicles and engines manufactured for the 2010 model year and thereafter.

(b) The requirement to file emission warranty information reports and field information reports for a given class or category of vehicles or engines shall be applicable for the warranty period but not to exceed the useful life period of the vehicles or engines beginning with the 1990 model-year vehicles or engines.

(c) The requirement to file an emissions information report for a given class or category of vehicles or engines shall be applicable for the useful life period of the vehicles or engines.

(d) In the case of motor vehicles or engines for which certification of the exhaust and evaporative emission control systems is granted to different manufacturers, the information reporting responsibility in subsections (b) and (c) above shall be assigned to the certifying manufacturer.

NOTE: Authority cited: Sections 39600, 39601, 43105 and 43106, Health and Safety Code. Reference: Sections 43000, 43009.5, 43018, 43101, 43104, 43105, 43106, 43107 and 43204–43205.5, Health and Safety Code.

§ 2142.0.1. Alternative Procedures. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) A vehicle manufacturer may use an alternative procedure to those specified in Sections 2144(a) and 2145(a), provided the Executive Officer has determined that the alternative procedure will produce substan-tially equivalent results. In making such a determination, the Executive Officer shall consider the capacity of the alternative procedure to:

(1) ensure early detection of failing components within the useful life of the vehicles or engines;
(2) track failing components by engine family;

(3) assure prompt notification of the Executive Office when a systematically failing component is indicated;

(4) provide objective, complete and easily monitored data; and

(5) be audited by the Executive Officer.

(b) If, in order to comply with the requirements of Section 2142(a), 2144(a) or 2145(a), a manufacturer elects to develop a system based upon a sampling of representative California dealerships, such plan must be reviewed and approved by the Executive Officer prior to its implementation.

NOTE: Authority cited: Sections 39600, 39601 and 43105, Health and Safety Code. Reference: Sections 43000, 43009.5, 43018, 43101, 43104, 43105, 43106, 43107 and 43204–43205.5, Health and Safety Code.

§ 2143.0.1. Failure Levels Triggering Recall. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

An engine family, test group or a subgroup shall be subject to a recall when the number of failures of a specific emission-related component exceeds the failure level set forth below, unless the Executive Officer determines from the emission information report that a recall is unnecessary pursuant to the criteria set forth in Section 2148(a) and (b). Vehicles or engines in an engine family or test group are subject to recall at the following failure levels: 4 percent or 50 (whichever is greater) for 1990 through 1991 model year vehicles or engines; 3 percent or 50 (whichever is greater) for 1992 through 1993 model-year vehicles or engines; and 2 percent or 50 (whichever is greater) for 1994 and subsequent model-year vehicles or engines. The Executive Officer may extend the applicability of the 4 or 3 percent failure levels if he/she determines that proceeding to the next lower level will create an excessive administrative burden on the CARB or the vehicle manufacturers without a corresponding benefit in the reduction of emissions.

NOTE: Authority cited: Sections 39600, 39601 and 43105, Health and Safety Code. Reference: Sections 43000, 43009.5, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

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§ 2144.0.1. Emission Warranty Information Report. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) A manufacturer shall:

(1) Review warranty claim records for each engine family or test group on a quarterly basis to determine and compile by cumulative total the number of claims made for emission-related components. The data compiled shall be based on all warranty claims, without any prescreening of data as to the validity of the claims. In the case of heavy-duty vehicles or engines, a manufacturer may use nationwide data for monitoring war-ranty claims of a California-certified engine family or test group which is also certified by the United States Environmental Protection Agency.

(2) Categorize warranty claims for each engine family or test group by the specific emission control component replaced or repaired.

(3) On the basis of data obtained subsequent to the effective date of these regulations, file an emission warranty information report for each quarter when the cumulative number of unscreened warranty claims for a specific emission-related component or repair represent at least one percent or twenty five (whichever is greater) of the vehicles or engines of a California-certified engine family or test group.

(b) The emission warranty information report shall contain the following information in substantially the format outlined below:

(1) The manufacturer's corporate name.

(2) A description of each class or category of California-certified vehicles or engines affected by a warranty replacement or warranty repair of a specific emission-related component, including model year and engine family or test group.

(3) The number and percentage of vehicles or engines in each engine family or test group for which a warranty replacement or warranty repair of a specific emission-related component was identified.

(4) A short description of the specific emission-related component that was replaced or repaired under warranty.

(c) Emission warranty information reports shall be submitted not more than 25 days after the close of a calendar quarter. Subsequent to the filing or an emission warranty information report, a manufacturer shall submit quarterly reports updating the number and percentage of emission-related warranty claims with the most recent information, unless a recall has been implemented. Emission warranty information reports and updates shall be submitted to the Chief, Emissions Certification and Compliance Division, 4001 Iowa Ave, Riverside, CA 92507.

(d) The records described in Section 2144(a)(1) of these procedures and the records used under the alternative procedure described in Section 2142(a) of these procedures shall be made available to the Executive Officer upon request.

NOTE: Authority cited: Sections 39600, 39601 and 43105, Health and Safety Code. Reference: Sections 43000, 43009.5, 43018, 43101, 43104, 43105, 43106, 43107 and 43204–41205.5, Health and Safety Code.

§ 2145.0.1. Field Information Report. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) On the basis of data obtained and reported pursuant to Section 2144 of these procedures, a manufacturer shall file a field information report not more than 45 days after an emission warranty information report indicates that a cumulative total of unscreened warranty claims for a specific emission-related component is found to exist in excess of the percentage of vehicles specified in Section 2143, unless the manufacturer has committed to perform a recall by notifying the CARB of its intent in writing within the 45-day period. A recall plan must be submitted within 45 days of that notice.

(b) All field information reports shall be submitted to the Chief, Emissions Certification and Compliance Division, 4001 Iowa Ave, Riverside, CA 92507, and shall contain the following information in substantially the format outlined below:

(1) The manufacturer's corporate name.

(2) A field information report number assigned by the manufacturer which shall be used in all related correspondence.

(3) A description of each class or category of California-certified vehicles or engines affected including make, model, model year, engine family or test group and such other information as may be required to identify the vehicles or engines affected. The description shall include those engine families or test groups related to the affected engine family or test group through common certification test data allowed under Title 40, Code of Federal Regulations, Section 86.085-24(f), as amended December 10, 1984 or Title 40 Code of Federal Regulations, Section 86.1839-01, as adopted May 4, 1999 ("carry-over" and "carry-across" engine families).

(4) A description of the emission-related component that failed or was replaced or repaired under warranty, the failure and the probable cause of the failure.

(5) The number and percentage of vehicles or engines in each engine family or test group for which a failure of a specific emission-related component was identified.

(6) The total number and percentage of unscreened warranty claims and failures of a specific emission-related component projected to occur during the engine family's or test group's useful life and a description of the method used to project this number.

(7) An estimated date when the failure of a specific emission-related component will reach the levels specified in Section 2143 of these procedures.

NOTE: Authority cited: Sections 39600, 39601 and 43105, Health and Safety Code. Reference: Sections 43000, 43009.5, 43018, 43101, 43104, 43105, 43106, 43107 and 43204–43205.5, Health and Safety Code.

§ 2146.0.1. Emissions Information Report. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) A manufacturer shall file an emissions information report:

(1) For 1990 and subsequent model-year vehicles or engines, when the failure of a specific emission-related component exceeds the percentages specified in Section 2143 of these procedures. An emissions infor-mation report shall not be required sooner than 45 days after the field information report has been submitted to the Executive Officer.

(2) Not more than 45 days after the Executive Officer, with cause, requires such a report. For purposes of this section, "cause" shall be based upon any information in CARB possession which indicates that a failure of significant scope is occurring which might necessitate a recall, includ-ing but not limited to the in-use enforcement test results specified in Section 2140(a) above, and information gathered from CARB in-use surveillance activities, Smog Check inspections, and consumer complaints.

(3) For 1982 through 1989 model-year vehicles or engines, not more than 15 days after a specific emission-related defect is determined to exist in twenty-five or more vehicles or engines of the same model year. A defect shall be determined in accordance with procedures established by a manufacturer to identify safety-related defects.

(b) No emissions information report shall be required if a manufacturer has committed to perform a recall by notifying the CARB of its intent in writing after the failure of a specific emission-related component exceeds the percentages specified in Section 2143 of these procedures. A recall plan shall be submitted within 45 days of the manufacturer's notification of intent to perform a recall.

(c) All emissions information reports shall be submitted to the Chief, Emissions Certification and Compliance Division, 4001 Iowa Ave, Riverside, CA 92507, and shall contain the following information in substantially the format outlined below. For purposes of this section, the term "failure" shall be considered synonymous with the term "defect" for those emissions information reports filed pursuant to subsection (a)(3), above.

(1) The manufacturer's corporate name.

(2) The field information report number from which the failure was first reported, if applicable.

(3) A description of each class or category of California-certified vehicles or engines affected by the failure including make, model, model year, engine family or test group, and such other information as may be required to identify the vehicles or engines affected.

(4) A description of the emission-related component that failed, the failure and the probable cause of failure.

(5) A description of any driveability problems or impact on other vehicle or engine performance factors such as fuel economy and cold starting likely to result from the failure.

(6) For emissions information reports filed pursuant to Section 2146(a)(1) and (2), a description of how emissions will be affected over the useful life of the vehicles or engines due to the failure.

(7) For emissions information reports filed pursuant to Section 2146(a)(3), an evaluation of the emission impact of the failure and any available emission data which relate to the failure.

NOTE: Authority cited: Sections 39600, 39601 and 43105, Health and Safety Code. Reference: Sections 43000, 43009.5, 43018, 43101, 43104, 43105, 43106, 43107 and 43204–43205.5, Health and Safety Code.

§ 2148.0.1. Evaluation of Need for Recall. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) Once the emission information report is filed, the Executive Officer shall evaluate the failure to determine whether a recall is necessary. Factors to be considered shall include but are not limited to the following:

(1) the validity of the data;

(2) the emission impact of the failure on individual vehicles or engines;

(3) the possibility of induced tampering due to driveability problems resulting from the failure;

(4) the effects of the failure on performance, fuel economy, and safety;

(5) the failure rates and the timing and extent of a remedy if no recall is required; and

(6) other factors specific to the failure.

(b) Notwithstanding subsection (a) above, a recall shall not be required if the manufacturer submits information with the emissions information report which demonstrates to the satisfaction of the Executive Officer that the failure

(1) is limited to an emission-related component on a less-than-substantial percentage of vehicles and does not represent a pervasive defect in design, application, or execution which is likely to affect a substantial number of such emission-related components during the useful life of the vehicle or engines, and

(2) is likely to be corrected under the warranty program or other in-use maintenance procedure shortly after the inception of the problem.

(c) If a manufacturer can identify a subgroup of an engine family or test group which is subject to a failure, a recall may be limited to that subgroup with Executive Officer approval.

NOTE: Authority cited: Sections 39600, 39601 and 43105. Health and Safety Code. Reference: Sections 43000, 43009.5, 43018, 43101, 43104, 43105, 43106, 43107 and 43204–43205.5. Health and Safety Code.

§ 2149.0.1. Notification and Subsequent Action. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) The Executive Officer shall notify the manufacturer of the evaluation results. If the Executive Officer deems a noncompliance exists, a manufacturer shall have 15 days upon receipt of CARB notification to notify the CARB in writing of its intent to perform a recall. A manufacturer may initiate one of the following recalls:

(1) A voluntary recall if the emissions information report submitted was required pursuant to Section 2146(a)(1) or (a)(3) of these procedures;

(2) An influenced recall if the emissions information report submitted was required pursuant to Section 2146(a)(2) of these procedures.

(b) If no notification to perform a voluntary or influenced recall is submitted by the manufacturer within the 15-day period specified in subsection (a) above, the CARB may initiate further investigation which could lead, respectively, to an influenced or ordered recall of the subject vehicles or engines.

(c) Following notification of noncompliance by the CARB, a manufacturer shall submit within 45 days a recall plan in accordance with Section 2113(a) or (b), Title 13, California Code of Regulations.

NOTE: Authority cited: Sections 39600, 39601 and 43105, Health and Safety Code. Reference: Sections 43000, 43009.5, 43018, 43101, 43104, 43105, 43106, 43107, 43204–43205.5, 43211–43213 and 43107, Health and Safety Code.

§ 2423.0.1. Exhaust Emission Standards and Test Procedures — Off-Road Compression-Ignition Engines. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) This section shall be applicable to new heavy-duty off-road compression-ignition engines, produced on or after January 1, 1996, and all other new 2000 and later model year off-road compression-ignition engines. For the purposes of this section, these engines shall be called "compression-ignition engines."

(b)(1)(A) Exhaust emissions from new off-road compression-ignition engines, as sold in this state and as appropriate based on model year and maximum rated power, shall not exceed the levels contained in Table 1a with respect to steady-state testing. Table 1a follows:

Table 1a. -- Tier 1, Tier 2, and Tier 3 Exhaust Emission Standards (grams per kilowatt-hour)

Maximum Rated Power (kW)[1]	Tier	Model Year	NOx[2]	HC[3]	NMHC + NOx[4]	CO[5]	PM[6]
kW<8	Tier 1	2000-2004	--	--	10.5	8.0	1.0
	Tier 2	2005-2007[7]	--	--	7.5	8.0	0.80
8≤kW<19	Tier 1	2000-2004	--	--	9.5	6.6	0.80
	Tier 2	2005-2007[7]	--	--	7.5	6.6	0.80
19≤kW<37	Tier 1	2000-2003	--	--	9.5	5.5	0.80
	Tier 2	2004-2007[7]	--	--	7.5	5.5	0.60
37≤kW<56	Tier 1	2000-2003	9.2	--	--	--	--
	Tier 2	2004-2007	--	--	7.5	5.0	0.40
	Tier 3[8]	2008-2011	--	--	4.7	5.0	0.40
56≤kW<75	Tier 1	2000-2003	9.2	--	--	--	--
	Tier 2	2004-2007	--	--	7.5	5.0	0.40
	Tier 3	2008-2011	--	--	4.7	5.0	0.40
75≤kW<130	Tier 1	2000-2002	9.2	--	--	--	--
	Tier 2	2003-2006	--	--	6.6	5.0	0.30
	Tier 3	2007-2011	--	--	4.0	5.0	0.30
130≤kW<225	Tier 1	1996-2002	9.2	1.3	--	11.4	0.54
	Tier 2	2003-2005	--	--	6.6	3.5	0.20
	Tier 3	2006-2010	--	--	4.0	3.5	0.20

225≤kW<450	Tier 1	1996-2000	9.2	1.3	--	11.4	0.54
	Tier 2	2001-2005	--	--	6.4	3.5	0.20
	Tier 3	2006-2010	--	--	4.0	3.5	0.20
450≤kW≤560	Tier 1	1996-2001	9.2	1.3	--	11.4	0.54
	Tier 2	2002-2005	--	--	6.4	3.5	0.20
	Tier 3	2006-2010	--	--	4.0	3.5	0.20
kW>560	Tier 1	2000-2005	9.2	1.3	--	11.4	0.54
	Tier 2	2006-2010	--	--	6.4	3.5	0.20

[1] kW means kilowatts.
[2] NOx means Oxides of Nitrogen.
[3] HC means Hydrocarbons.
[4] NMHC + NOx means Non-Methane Hydrocarbons plus Oxides of Nitrogen.
[5] CO means Carbon Monoxide.
[6] PM means Particulate Matter.
[7] Tier 2 standards for propulsion marine compression-ignition engines below 37 kW remain in effect beyond the 2007 end date.
[8] Manufacturers may optionally certify engine families to the interim Tier 4 standards in Table 1b for this power category through 2012.

(B) Exhaust emissions from new off-road compression-ignition engines, as sold in this state and as appropriate based on model year and maximum engine power, shall not exceed the levels contained in Table 1b, with respect to steady-state testing, transient testing, and, after application of the criteria in Table 1c, not-to-exceed testing, as applicable. Other compliance options are permissible as provided in the 2008 and Later Test Procedures.

Table 1b. -- Tier 4 Exhaust Emission Standards (grams per kilowatt-hour)

Maximum Engine Power	*Model Year*	*Type*	*PM*	*NMHC +NOx*	*NMHC*	*NOx*	*CO*
			grams per kilowatt-hour				
kW<8[1]	2008 and later	Final	0.40[2]	7.5	-	-	8.0
8≤kW<19[1]							6.6
19≤kW<37[1]	2008-2012	Interim	0.30	7.5	-	-	5.5
	2013 and later	Final	0.03	4.7			
37≤kW<56[3]	2008-2012	Interim	0.30	4.7	-	-	5.0
	2013 and later	Final	0.03				
56≤kW<75	2012-2014[4]	Phase-In	0.02	-	0.19	0.40	5.0
		Phase-Out		4.7	-	-	
		or/ Alt NOx		-	0.19	3.4[5]	
		or/ Alt NO_x+NMHC[8]		3.5[5]	-	-	
	2015 and later	Final		-	0.19	0.40	
75≤kW<130	2012-2014[4]	Phase-In	0.02	-	0.19	0.40	5.0
		Phase-Out		4.0	-	-	
		or/ Alt NOx		-	0.19	3.4[5]	
		or/ Alt NO_x+NMHC[8]		3.5[5]	-	-	
	2015 and later	Final		-	0.19	0.40	
130≤kW≤560	2011-2013	Phase-In	0.02	-	0.19	0.40	3.5
		Phase-Out		4.0	-	-	
		or/ Alt NOx		-	0.19	2.0	
		or/ Alt NO_x+NMHC[8]		2.1	-	-	
	2014 and later	Final		-	0.19	0.40	
560 kW<GEN[6]≤900 kW	2011-2014	Interim	0.10	-	0.40	3.5	3.5
	2015 and later	Final	0.03		0.19	0.67	
GEN>900 kW	2011-2014	Interim	0.10	-	0.40	0.67	3.5
	2015 and later	Final	0.03		0.19		
ELSE[7]>560 kW	2011-2014	Interim	0.10	-	0.40	3.5	3.5
	2015 and later	Final	0.04		0.19		

Notes:

[1] Propulsion marine compression-ignition engines below 37 kW are not subject to Tier 4 standards or requirements. All previously adopted requirements remain applicable for these engines.

[2] The Tier 4 PM standard for hand-start, air cooled, direct injection engines below 8 kW is 0.60 g/kW-hr, but is not required until 2010.

[3] Engine families in this power category may alternately meet Tier 3 PM standards from 2008-2011 in exchange for introducing final PM standards in 2012.

[4] Manufacturers have the option of complying with the Tier 4 standards over a two year period at 50% per year using banked Tier 2 credits or over a three year period at 25% per year without the use of Tier 2 credits. The three year phase-in period is shown. The 2014 model year cannot extend beyond December 30, 2014, when the 3 year phase-in option is used.

[5] Manufacturers may comply with the standards during the transitional implementation years using either a phase-in/phase-out approach or by using the Alternate NOx approach. The three year 25% alternate NOx standard is shown in the table. The two year 50% phase-in NOx standard would be 2.3 g/kW-hr.

[6] "GEN" refers to generator engines only.
[7] "ELSE" refers to all mobile machinery excluding generator engines.
[8] An ALT NOx+NMHC standard equal to 0.5 g/kW-hr is available for one additional model year following the last model year of the ALT NOx+NMHC phase-in shown in the table.

Table 1c. -- Criteria for Determining NTE Limits[1]

Pollutant	Apply NTE Multiplier of 1.25 when ...	Apply NTE Multiplier of 1.50 when ...
NOx	NOx Standard or FEL≥2.5 g/kW-hr	NOx Standard[2] or FEL<2.5 g/kW-hr
NMHC	NOx Standard or FEL≥2.5 g/kW-hr	NOx Standard[2] or FEL<2.5 g/kW-hr
NMHC + NOx	NMHC+NOx Standard or FEL≥2.7 g/kW-hr	NMHC + NOx Standard[2] or FEL<2.7 g/kW-hr
PM	PM Standard or FEL≥0.07 g/kW-hr	PM[2] Standard or FEL[3]<0.07g/kW-hr
CO	Always	Never

Notes:

[1] Other provisions described in the 2008 and Later Test Procedures may affect the calculation of NTE limits.

[2] Engines must be certified to these standards without the use of ABT credits.

[3] For engines certified to a PM FEL less than or equal to 0.01 g/kW-hr, the PM NTE limit shall be 0.02 g/kW-hr.

(2) Manufacturers may elect to include engine families in one of two averaging, banking, and trading (ABT) programs, corresponding to the engine family's model year and emissions categorization. The provisions of these separate ABT programs are specified in Part 89, Subpart C of the 2000 Plus Limited Test Procedures and Part 1039, Subpart H of the 2008 and Later Test Procedures.

(A) For engine families subject to the 2000 Plus Limited Test Procedures, the manufacturer must set a family emission limit (FEL) not to exceed the levels contained in Table 2a. The FEL established by the manufacturer serves as the emission standard for that engine family. Table 2a follows:

Table 2a -- Upper Limit for Tier 1, Tier 2, and Tier 3 Family Emission Limits (FEL) (grams per kilowatt-hour)

Maximum Rated Power (kW)	Tier	Model Year	NOx	NMHC + NOx	PM FEL
kW<8	Tier 1	2000-2004		16.0	1.2
	Tier 2	2005-2007		10.5	1.0
8≤kW<19	Tier 1	2000-2004		16.0	1.2
	Tier 2	2005-2007		9.5	0.80
19≤kW<37	Tier 1	2000-2003		16.0	1.2
	Tier 2	2004-2007		9.5	0.80
37≤kW<56	Tier 1	2000-2003	14.6		
	Tier 2	2004-2007		11.5	1.2

	Tier 3[1]	2008-2011		7.5	1.2
56≤kW<75	Tier 1	2000-2003	14.6		
	Tier 2	2004-2007		11.5	1.2
	Tier 3	2008-2011		7.5	1.2
75≤kW<130	Tier 1	2000-2002	14.6		
	Tier 2	2003-2006		11.5	1.2
	Tier 3	2007-2011		6.6	1.2
130≤kW<225	Tier 1	2000-2002	14.6		
	Tier 2	2003-2005		10.5	0.54
	Tier 3	2006-2010		6.6	0.54
225≤kW<450	Tier 1	2000	14.6		
	Tier 2	2001-2005		10.5	0.54
	Tier 3	2006-2010		6.4	0.54
450≤kW≤560	Tier 1	2000-2001	14.6		
	Tier 2	2002-2005		10.5	0.54
	Tier 3	2006-2010		6.4	0.54
kW>560	Tier 1	2000-2005	14.6		
	Tier 2	2006-2010		10.5	0.54

[1] Manufacturers may optionally certify engine families to the interim Tier 4 FEL caps in Table 2b for this power category through 2012.

(B) For engine families subject to the 2008 and Later Test Procedures, the manufacturer must set a family emission limit (FEL) not to exceed, as applicable, the levels contained in Table 2b. Three distinct FEL types (primary, interim, and alternate) are available conditionally. Primary FEL types are applicable to all power categories indefinitely, whereas interim and alternate FEL types are of variable duration and may be selectively applied to total or partial engine family production volumes as described in the 2008 and Later Test Procedures. The FEL established by the manufacturer serves as the emission standard for that engine family, and is used for determining NTE limits in conjunction with the criteria in Table 1c. Temporary compliance adjustment factors, as explained in the 2008 and Later Test Procedures, shall be applied by the manufacturer to compensate for the use of transitional alternate FELs (Type ALT 20% in Table 2b) when calculating emission credits. Table 2b follows:

Table 2b -- Upper Limit for Tier 4 Family Emission Limits (FELs) and Alternate Allowances Part 1

Maximum Engine Power	*FEL Type*	*Model Year*	*PM*	*NOx*	*NMHC +NOx*
			grams per kilowatt-hour		
kW<8	Primary	2008 and later	0.80	-	10.5
8≤kW<19	Primary	2008 and later	0.80	-	9.5
19≤kW<37	Interim	2008-2012	0.60	-	9.5
	Primary	2013 and later	0.05	-	7.5
	ALT 20%[1]	2013-2016[3]	0.30	-	7.5
	ALT 5%[2]	2017 and later[3]			
37≤kW<56	Interim	2008-2012[3]	0.40	-	7.5
	Primary	2013 and later[3]	0.05	-	7.5
	ALT 20%	2013-2016[3]	0.30	-	7.5
	ALT 5%	2017 and later[3]			
56≤kW<75	Phase-in	2012-2013/2014[5]	0.04	0.80	-
	Phase-out			-	7.5
	ALT NOx Std[4]	2012-2013	0.04	3.0[7]	-
		2012-2014		4.4	
	ALT NO_x+NMHC Std[4]	2012-2013/2014[5]	0.04	-	4.7[7]
	Primary	2014/2015[5] and later	0.04	0.80	-
	ALT 20% PM	2012-2015	0.40		-
	ALT 20% NOx	2012-2015[6]		4.4	-
	ALT 20% NO_x+NMHC Std	2012-2015[6]	-	-	4.7
	ALT 5%	2016 and later	0.40	4.4	-

Notes:

[1] This alternate FEL option is transitional for the four years specified and applies to at most 20% of a manufacturer's U.S. directed population of engine families per year.

[2] This alternate FEL option is available indefinitely, but only applies to 5% of a manufacturer's U.S. directed population of engine families per year.

[3] These dates correspond to the compliance option of meeting interim standards in 2008; else the primary and alternate FEL caps would begin and end one year earlier, and 2008-2011 engines would not be eligible for participation in the Tier 4 ABT program.

[4] Two alternate NOx standards and corresponding FEL caps are available for this category with corresponding alternate phase-in options.

and use of banked Tier 2 NO_x credits

[5] The effective date of the primary FEL cap follows the phase-in period of the selected NOx FEL cap.

[6]

[7] If neither the alternate phase-in option nor banked Tier 2 credits are used, either NOx standard and corresponding FEL may be applied for this category.

For manufacturers certifying engines in this power category using a percentage phase-in/phase-out approach instead of the ALT NO_x or ALT NO_x+NMHC standards in Table 16 of §2423(b)(1)(B), the alternate NO_x and NO_x+NMHC FEL caps in the 485 table apply only in the 2014-2015 model years if certifying in accordance with the provisions in §1039.102(d)(1) of the 2011 and later Test procedures, and only in the 2015 model year if certifying under 1039.102(d)(2) of the 2011 and later Test proced

10/2/15 PER AGENCY REQUEST LSM

Table 2b -- Upper Limit for Tier 4 Family Emission Limits (FELs) and Alternate Allowances Part 2

Maximum Engine Power	*FEL Type*	*Model Year*	*PM*	*NOx*	*NMHC +NOx*
			grams per kilowatt-hour		
75≤kW<130	Phase-in	2012-2013/2014[5]	0.04	0.80	-
	Phase-out			-	6.6
	ALT NOx Std[4]	2012-2013		3.0[7]	-
		2012-2014		3.8	-
	ALT NOx+NMHC Std[4]	2012-2013/2014[5]		-	4.0[7]
	Primary	2014/2015[5] and later		0.80	-
	ALT 20% PM	2012-2015	0.30		-
	ALT 20% NOx	2012-2015[6]		3.8	-
	ALT 20% NO_x+NMHC Std[4]	2012-2015[6]	-	-	4.0
	ALT 5%	2016 and later	0.30	3.8	-
130≤kW≤560	Phase-in	2011-2013	0.04	0.80	-
	Phase-out			-	6.6/6.4[8]
	ALT NOx Std	2011-2013		2.7	-
	ALT NOx+NMHC Std	2011-2013		-	4.0
	Primary	2014 and later		0.80	-
	ALT 20% PM	2011-2014	0.20		-
	ALT 20% NOx	2011-2014[9]		3.8	-
	ALT 20% NOx+NMHC Std	2011-2014[9]	-	-	4.0
	ALT 5%	2015 and later	0.20	3.8	-
GEN>560kW	Interim	2011-2014	0.20	6.2	-
	Primary	2015 and later	0.05	1.07	-
	ALT 20%	2015-2018	0.10	3.5	-
	ALT 5%	2019 and later			-
ELSE>560kW	Interim	2011-2014	0.20	6.2	-
	Primary	2015 and later	0.07		-
	ALT 20%	2015-2018	0.10		-
	ALT 5%	2019 and later			-

Notes:

[4] Two alternate NOx standards and corresponding FEL caps are available for this category with corresponding alternate phase-in options.

[5] The effective date of the primary FEL cap follows the phase-in period of the selected NOx FEL cap.

[6]

[7] If neither the alternate phase-in option nor banked Tier 2 credits are used, either NOx standard and corresponding FEL may be applied for this category.

[8] The phase-out NMHC + NOX FEL cap is 6.6 g/kW-hr for engines <225 kW, and 6.4g/kW-hr for engines ≥225kW in this category.

[9] For manufacturers certifying engines in this power category using the percentage phase-in/phase-out approach instead of the ALT NOx standard or the ALT NOx+NMHC standard in Table 1b of §2423(b)(1)(B), the ALT NOx and ALT NOx+NMHC FEL caps in the table apply only for the 2014 model year.

10/2/25 PER AGENCY REQUEST LSM

For manufacturers certifying engines in this power category using a percentage phase-in/phase-out approach instead of the ALT NOx or ALT NOx + NMHC standards in Table 1b of § 2423(b)(1)(B), the alternate NOx and NOx + NMHC FEL caps in the table apply only in the 2014-2015 model years if certifying in accordance with the provisions in §1039.102(d)(1) of the 2011 and later Test Procedures, and only in the 2015 model year if certifying to §1039.102(d)(2) of the 2011 and later Test Procedures.

(C) Split family provision. For generating or using credits in the 56≤kW≤560 power categories during the phase-in of Tier 4 standards, engine manufacturers may elect to split an engine family into two subfamilies (e.g., one which uses credits and one which generates credits for the same pollutant). The engine manufacturer must indicate in the application for certification that the engine family is to be split, and may calculate emission credits relative to different emissions standards (i.e., phase-in and phase-out standards) for different sets of engines within the engine family, but must certify the engine family to a single set of standards and FELs. The engine manufacturer shall calculate NMHC + NOx emission credits by adding the NOx FEL to the NMHC phase-in standard for comparison with the applicable NMHC + NOx phase-out standard. Any engine family certified under the provisions of this paragraph (C) must meet the applicable phase-in standard for NMHC. The engine manufacturer shall be responsible for assigning the number and configurations of engines within the respective subfamilies before the due date of the final report required in Part 1039, Subpart H of the 2008 and Later Test Procedures. The same label must be applied to each engine in the family, and must include the NOx FEL to which the engine is certified.

(3)(A) The opacity of smoke emissions from new 1996 through 1999 model year heavy-duty off-road compression-ignition engines 175 to 750 horsepower, inclusive, or from all new 2000 and later model year compression-ignition engines sold in this state, shall not exceed, based on the applicable measurement techniques specified in Part 89, Subpart B of the 2000 Plus Limited Test Procedures and Part 1039, Subpart B of the 2008 and Later Test Procedures, the following:

1. 20 percent during the engine acceleration mode.

2. 15 percent during the engine lugging mode.

3. 50 percent during the peaks in either mode.

(B) The following engines are exempt from the requirements of this paragraph (3):

1. Single-cylinder engines.

2. Propulsion marine compression-ignition engines.

3. Constant-speed engines.

4. Engines certified to a PM emission standard or FEL of 0.07 grams per kilowatt-hour or lower

(4) Low-emitting Blue Sky Series engines requirements.

(A) Voluntary standards. Engines subject to the standards in (b)(1)(A) may be designated "Blue Sky Series" engines by meeting the voluntary standards contained in Table 3, which apply to all certification and in-use testing. Blue Sky Series engines shall not be included in the Averaging, Banking, and Trading program. Table 3 follows:

Table 3. -- Voluntary Emission Standards (grams per kilowatt-hour)

Maximum Rated Power (kW)	NMHC + NOx	PM
kW<8	4.6	0.48
8≤kW<19	4.5	0.48
19≤kW<37	4.5	0.36
37≤kW<75	4.7	0.24
75≤kW<130	4.0	0.18
130≤kW≤560	4.0	0.12
kW>560	3.8	0.12

(B) Additional standards. Blue Sky Series engines are subject to all provisions that would otherwise apply under this part, except as specified in (b)(4)(C) of this section.

(C) Test Procedures. NOx, NMHC, and PM emissions are measured using the procedures set forth in 40 CFR part 86, subpart N (July 1, 1999), which is incorporated by reference, in lieu of the procedures set forth in subpart E of the 2000 Plus Limited Test Procedures. CO emissions may be measured using procedures set forth in 40 CFR part 86, subpart N (July 1, 1999), or in subpart E of the 2000 Plus Limited Test Procedures. Manufacturers may use an alternate procedure to demonstrate the desired level of control if approved in advance by the Executive Officer. Engines meeting the requirements to qualify as Blue Sky Series engines must be capable of maintaining a comparable level of emission control when tested using the procedures set forth in both Section 89.112(c) and subpart E of the 2000 Plus Limited Test Procedures. The numerical emission levels measured using the procedures from subpart E of the 2000 and Plus Limited Procedures may be up to 20 percent higher than those measured using procedures from 40 CFR part 86, subpart N (July 1, 1999), and still be considered comparable.

(5)(A) No crankcase emissions shall be discharged into the ambient atmosphere from any new 1996-1999 model year heavy-duty off-road compression-ignition engine or any Tier 2 or later off-road compression-ignition engine subject to the 2000 Plus Limited Test Procedures. This provision does not apply to petroleum-fueled diesel cycle engines using turbochargers, pumps, blowers, or superchargers for air induction.

(B) For off-road compression-ignition engines subject to the 2008 and Later Test Procedures, no crankcase emissions shall be discharged directly into the ambient atmosphere from any engine, unless the sum of those discharged emissions are added to the exhaust emissions (either physically or mathematically) during all emission testing. To be eligible for this option, a manufacturer must design its engines so that all crankcase emissions can be routed into the applicable sampling systems specified in the 2008 and Later Test Procedures, and must account for deterioration in crankcase emissions when determining exhaust deterioration factors. Crankcase emissions that are routed to the exhaust upstream of exhaust aftertreatment during all operation are not considered to be discharged directly into the ambient atmosphere. Furthermore, engines using charge-air compression that are certified to a transitional alternate FEL (Type ALT 20% in Table 2b) during the first four years of the Tier 4 standards for the applicable power category are exempt from this subsection, but must instead comply with the requirements in Section 2423(b)(5)(A).

(6) Engine manufacturers that voluntarily certify engines to the Tier 4 standards in Table 1b earlier than required under this article may, according to the provisions in the 2008 and Later Test Procedures, generate additional ABT credits, or as an alternative, offset future Tier 4 compliance requirements should the equipment manufacturer that was provided the engine decline to use its early introduction incentives according to the provisions in Section 2423(d)(9). Table 4, as follows, summarizes the incentives for the early introduction of Tier 4 engines and some of the conditions that determine eligibility.

Table 4. -- Early Introduction Incentives for Engine Manufacturers

Early Introduction	Power Category	Qualifying Standards[1] grams per kilowatt-hour	Per Engine Incentive
Final Tier 4 PM-Only[2]	19≤kW<56	0.03 PM	3 for 2 PM-Only
	56≤kW<560	0.02 PM	
Final Tier 4 All	19≤kW<56	0.03 PM/4.7 NMHC + NO_x	3 for 2
	56≤kW≤560	0.02 PM/0.40 NOx/0.19 NMHC	
	GEN>560	0.03 PM/0.67 NOx/0.19 NMHC	
	ELSE≥560	0.04 PM/3.5 NOx/0.19 NMHC	
Ultra Low NOx	kW≥19	Final Tier 4 PM & NMHC/0.20 NOx	2 for 1

Notes:

[1] All engines must meet the Tier 4 crankcase emissions requirements. Engines must certify using all test and other requirements otherwise required for final Tier 4 standards such as for transient and not-to-exceed limits.

[2] Offsets must be earned prior to the start of phase-in requirements (prior to 2013 for 19≤kW<56 engines, prior to 2012 for 56≤kW<130 engines, prior to 2011 for 130≤kW≤560 engines, prior to 2015 for >560 kW engines)

(7) Provisions for small-volume manufacturers. Small-volume engine manufacturers are entitled to special compliance provisions under this paragraph, but must notify the Executive Officer in writing before January 1, 2008, of the intent to use the provisions.

(A) Small-volume engine manufacturers may delay complying with certain otherwise applicable Tier 4 emission standards and requirements as described in the following table:

Table 5. -- Small-Volume Engine Manufacturer Provisions

Maximum Engine Power	Temporary Relief Replacement Standards	Delay End Date (Model Year)
kW<19	Tier 2	2011
19≤kW<37	Interim Tier 4	2016
37≤kW<56	See paragraph (7)(B) of this section for special provisions that apply for engines in this power range.	
56≤kW<130	Tier 3	2015

(B) The provisions of this paragraph (7) for engines 37≤kW<56 are applicable per one of the following options:

1. Manufacturers that comply with the 0.30 g/kW-hr PM standard in all model years from 2008 through 2012 without using PM credits may continue meeting that standard through 2015.

2. Manufacturers that choose not to comply with paragraph (7)(B)1. of this section may continue to comply with the standards and requirements in the 2000 Plus Limited Test Procedures for model years through 2012, but must begin complying in 2013 with the Tier 4 standards and requirements specified in Table 1b for model years 2013 and later.

(C) After the period of relief indicated in paragraphs (7)(A) and (B) of this section has expired, small-volume engine manufacturers must comply with the same Tier 4 standards and requirements as all other manufacturers.

(D) For engines not in the 19≤kW<56 power range, small volume engine manufacturers must meet the following conditions for the model years in which compliance with the otherwise applicable standards under this paragraph (7) is delayed:

1. Produce engines that meet all the emission standards and other requirements under the 2000 Plus Limited Test Procedures applicable for that model year, except as noted in this paragraph (7).

2. Meet the labeling requirements in the 2000 Plus Limited Test Procedures, but must use the following in place of the otherwise required statement of compliance in Section 2424(c)(2): "THIS ENGINE COMPLIES WITH CALIFORNIA REGULATIONS FOR [CURRENT MODEL YEAR] OFF-ROAD COMPRESSION-IGNITION ENGINES UNDER 13 CCR 2423(b)(7)." The referencing of similar federal requirements under this provision is permitted.

3. Small-volume engine manufacturers must notify the equipment manufacturer that the engines produced under this section are excluded from the production volumes associated with the equipment manufacturer flexibility program in Section 2423(d).

(E) For engines in the 19≤kW<56 power range, small-volume engine manufacturers must meet the following conditions for the model years in which compliance with the otherwise applicable standards under this paragraph (7) is delayed:

1. Produce engines in those model years that meet all the emission standards and other requirements that applied for model year 2008 engines in the same power category.

2. Meet the labeling requirements in Section 2424(c)(3), but use the following compliance statement instead of the compliance statement in Section 2423(c)(3): "THIS ENGINE COMPLIES WITH CALIFORNIA REGULATIONS FOR [CURRENT MODEL YEAR] OFF-ROAD COMPRESSION-IGNITION ENGINES UNDER 13 CCR 2423(b)(7)." The referencing of similar federal requirements under this provision is permitted.

3. Notify the equipment manufacturer that engines produced under this section are excluded from the production volumes associated with the equipment-manufacturer allowance program in Section 2423(d).

(F) The provisions of this paragraph (7) may not be used to circumvent the requirements of this article.

(8) Useful life. For purposes of certification, a manufacturer must demonstrate compliance with the standards set forth in this paragraph (b) over the full useful life of the engine, as defined in the applicable test procedures.

(9) NTE deficiencies. A manufacturer may petition the Executive Officer to accept an off-road compression-ignition engine as compliant with the NTE requirements specified in the 2008 and Later Test Procedures even though specific elements of those requirements may not be fully met. Such grants of compliance, otherwise known as deficiencies, shall be limited to engines that have functioning emission-control hardware capable of allowing the engine to comply with the NTE limits.

Deficiencies shall be granted by the Executive Officer according to the following stipulations:

(A) A manufacturer must apply for specific deficiencies at the time of, or prior to, submitting its application for certification. Deficiencies shall be assigned for an engine model within an engine family. The Executive Officer shall not approve deficiencies that are requested retroactively to cover engines already certified. The scope of each deficiency must be clearly identified in the certification application, and any auxiliary emission control device(s) used to control emissions to the lowest practical level must be identified with respect to each deficiency that is being requested.

(B) Deficiencies shall only be approved if compliance would be infeasible or unreasonable considering factors such as the technical feasibility of the given hardware, the availability of lead time, production cycles including the phase-in or phase-out of engines or vehicle designs, and planned computers upgrades. Other relevant factors may be considered.

(C) Deficiencies shall expire after a single model year and may be limited to specific engine configurations. The Executive Officer may approve a manufacturer's request for the same deficiency in the following model year if correcting the deficiency would require extreme hardware or software modifications and the manufacturer has demonstrated an acceptable level of effort toward complying.

(D) The number of deficiencies available to a manufacturer shall not be limited during the first three model years in which NTE limits apply to the manufacturer's engines. For the next four model years, up to three deficiencies per engine family shall be available to a manufacturer. Deficiencies of the same type that apply similarly to different power ratings within a family shall count as one deficiency per family. The Executive Officer may conditionally approve additional deficiencies during these four years, but may impose stipulations on their applicability as appropriate. Deficiencies shall not be approved beyond the seven-year period specified in this paragraph (8).

(10) Adjustable parameters. Manufacturers that design engines with adjustable parameters must meet all the requirements of this paragraph (b) for any adjustment in the physically adjustable range. An operating parameter is not considered adjustable if it is permanently sealed or if it is not normally accessible using ordinary tools. The Executive Officer may require that the adjustable parameters be set to any specification within the adjustable range during any testing, including certification testing, selective enforcement auditing, or in-use testing.

(11) Prohibited controls. A manufacturer shall not design engines with emission control devices, systems, or elements of design that cause or contribute to an unreasonable risk to public health, welfare, or safety while operating.

(12) Defeat devices. Engines equipped with a defeat device shall not be certified for sale in California. A defeat device is a component or system that reduces the effectiveness of emission controls under conditions that the engine may reasonably be expected to encounter during normal operation and use. This prohibition does not apply to auxiliary-emission control devices identified in the certification application if one of more of the following is true:

(A) The operating conditions where the auxiliary-emission control device is active were substantially encountered during all testing requirements as described in Part 1039, Subpart F of the 2008 and Later Test Procedures.

(B) The design of the auxiliary-emission control device is shown to be necessary for preventing engine (or equipment) damage or accidents.

(C) The auxiliary-emission control device only reduces the effectiveness of emissions control during engine starting.

(c)(1) The test procedures for determining certification and compliance with the standards for gaseous exhaust emissions from new 1996-1999 heavy-duty off-road compression-ignition engines sold in the state are set forth in the 1996-1999 Heavy-Duty Test Procedures.

(2)(A) The test procedures for determining certification and compliance with the standards for gaseous exhaust emissions and the standards for opacity of smoke emissions from new 2000 model year and later off-road compression-ignition engines for which the standards in paragraph (b)(1)(A) are applicable, and sold in the state, are set forth in the 2000 Plus Limited Test Procedures.

(B) The test procedures for determining certification and compliance with the standards for gaseous exhaust emissions, particulate exhaust emissions, opacity of smoke emissions, and not-to-exceed emissions from new 2008 model year and later off-road compression-ignition engines for which the limits in paragraph (b)(1)(B) are applicable, and sold in the state, are set forth in the 2008 and Later Test Procedures.

(3) The test procedures for determining certification and compliance with the standards for particulate exhaust emissions from new 1996 and later off-road compression-ignition engines for which the standards in paragraph (b)(1)(A) are applicable, and sold in the state, are set forth in the PM and Test Cycle Limited Test Procedures.

(4) The test procedures for determining certification and compliance with the standards for the opacity of smoke emissions from new 1996-1999 off-road compression-ignition engines sold in the state are set forth in the 1996-1999 Smoke Test Procedures.

(d) Implementation flexibility for equipment and vehicle manufacturers and post-manufacture marinizers. For a limited time, off-road equipment and vehicle manufacturers and post-manufacture marinizers may produce equipment with engines that are subject to less stringent emission standards than required by Tables 1a and 1b for new 2000 model year and later off-road equipment and vehicles and marine compression-ignition engines, subject to the requirements of paragraph (e) of this section. Separate provisions are provided for equipment with engines subject to the 2000 Plus Limited Test Procedures versus equipment with engines subject to the 2008 and Later Test Procedures, and are identified accordingly in the following subsections. Only manufacturers that have primary responsibility for designing and manufacturing equipment, and have manufacturing procedures for installing engines in equipment, are eligible to participate in the equipment manufacturer flexibility program provided by the 2008 and Later Test Procedures. Equipment manufacturers participating in this flexibility program must comply with the notification and reporting requirements specified in Section 2423(d)(7). Engines produced for this flexibility program using FELs greater than the applicable standards must be offset with sufficient ABT credits. The following allowances apply separately to each engine power category subject to standards under Section 2423(b)(1):

(1) Percent-of-production allowances.

(A) Equipment rated at or above 37kW and subject to the 2000 Plus Limited Test Procedures. A manufacturer may produce equipment and vehicles with engines rated at, or above, 37kW that are exempted from meeting current model year emission standards for a portion of its California-directed production volume. These percent-of-production flexibility allowances must be used within the seven years immediately following the date on which Tier 2 engine standards first apply to engines used in such equipment and vehicles, provided that the seven-year sum of the U.S.-directed portion of the manufacturer's percent-of-production flexibility allowances does not exceed 80 percent, expressed in cumulative yearly percentage increments, and provided that all such equipment and vehicles contain only engines that have been certified to the Tier 1 or Tier 2 standards;

(B) Equipment rated under 37kW and subject to the 2000 Plus Limited Test Procedures. A manufacturer or post-manufacture marinizer may produce equipment and vehicles and marine engines with engines rated under 37kW that are exempt from meeting current model year emission standards for a portion of its California-directed production volume. These percent-of-production flexibility allowances must be used within the seven years immediately following the date on which Tier 1 engine standards first apply to engines used in such equipment and vehicles and marine engines, provided that the seven-year sum of the U.S.-directed portions of the manufacturer's percent-of-production flexibility allowances, does not exceed 80 percent, expressed in cumulative yearly percentage increments;

(C) Equipment subject to the 2008 and Later Test procedures. A manufacturer may produce equipment and vehicles with engines that are exempt from meeting current model year emission standards for a portion of its California-directed production volume. These percent-of-production flexibility allowances must be used within one of the seven-year flexibility usage periods specified in Table 6 for each applicable power category, provided that the seven-year sum of the U.S.-directed portion of the manufacturer's percent-of-production flexibility allowances does not exceed 80 percent, expressed in cumulative yearly percentage increments, except as provided for in paragraph (d)(6) or (f). Equipment used as percent-of-production flexibility allowances must contain only engines that have been certified to, at least, the standards listed in Table 6, corresponding to the flexibility usage period selected by the manufacturer. All flexibility allowances for a power category must be used within the same flexibility usage period.

Table 6. -- Tier 4 Flexibility Allowance Options

Power Category	7 Year Usage Period	Flexibility Standard
<19 kW	2008-2014	Tier 2
19≤kW<56	2008-2014[1]	Tier 3[2]
	2012-2018	2008 Interim Tier 4
56≤kW<130	2012-2018	Tier 3
	2014-2020	2012 Interim Tier 4
130≤KW≤560	2011-2017	Tier 3
	2014-2020	2011 Interim Tier 4
>560 kW	2011-2017	Tier 2
	2015-2021	2011 Interim Tier 4

Notes:

[1] This usage period is not available for allowances greater than or equal to 37 kW unless interim Tier 4 standards have been met starting in 2008.

[2] Flexibility allowances under 37kW may contain engines certified to the Tier 2 standards.

(2)(A) Small volume allowances subject to the 2000 Plus Limited Test Procedures. An off-road equipment or vehicle manufacturer or post-manufacture marinizer may exceed the production percentages in paragraphs (d)(1)(A) and (B) of this section for a portion of its California-directed production, provided that in each regulated power category the manufacturer's total number of U.S.-directed off-road equipment and vehicles and marine diesel applications that contain engines which are exempt from meeting current model year emission standards over the years in which the percent-of-production allowance applies:

1. does not exceed 100 units times the number of years in which the percent-of-production allowance applies, and

2. does not exceed 200 units in any year, and

3. does not use engines from more than one engine family.

(B) Small volume allowances subject to the 2008 and Later Test Procedures. As an alternative to the percent-of-production allowance in Section 2423(d)(1)(C), an off-road equipment or vehicle manufacturer may produce equipment with engines that are exempt from meeting current model year emission standards for a portion of its California-directed production volume, provided that the exempt equipment is a subset of the manufacturer's U.S.-directed volume of exempt equipment and the manufacturer is in compliance with the following provisions:

1. Single engine family provision. A manufacturer may claim up to 700 U.S.-directed flexibility allowances within a power category during one of the seven-year flexibility usage periods specified in Table 6, but no more than 200 allowances in a single year within a power category, except as provided for in paragraph(d)(6) or (f). Engines within a power category that are used in these flexibility allowances must be from a single engine family within a given year.

2.a. Multiple engine family provision for flexibility allowances below 130 kW. A manufacturer may claim up to 525 U.S.-directed flexibility allowances within a power category during one of the seven-year flexibility usage periods specified in Table 6, but no more than 150 allowances in a single year within a power category, except as provided for in paragraph (d)(6) or (f). Engines within a power category that are used in these flexibility allowances may be from multiple engine families within a given year.

b. Multiple engine family provision for flexibility allowances at or above 130 kW. A manufacturer may produce up to 350 U.S.-directed flexibility allowances within a power category during one of the seven-year flexibility usage periods specified in Table 6, but no more than 100 allowances in a single year within a power category, except as provided for in paragraph (d)(6) of (f). Engines within a power category that are used in these flexibility allowances may be from multiple engine families within a given year.

(3)(A) Inclusion of previous-tier engines. Off-road equipment and vehicles and marine diesel engines built with previous tier or noncertified engines under the existing inventory provisions of the 2000 Plus Limited Test Procedures (40 CFR Section 89.1003(b)(4)) need not be included in determining compliance with paragraphs (d)(1)(A) and (B) and (d)(2)(A) of; this section.

(B) Inclusion of engines not subject to Tier 4 requirements. Off-road equipment and vehicles built with engines otherwise exempt from the requirements of the 2008 and Later Test Procedures are not required to be counted toward the percentage, or number, of claimed flexibility allowances under the provisions in Subsections (d)(1)(C) and (d)(2)(B). Such exempted engines include unused inventories produced prior to the effective date of the Tier 4 standards, excluding

stockpiled engines, and hand-startable, air cooled, direct-injection engines below 8 kW in 2008 and 2009 that do not meet the Tier 4 PM standard. Nonetheless, manufacturers may choose to include these engines in the count of total equipment produced from which the percentage of flexibility allowances in Subsection (d)(1)(C) is derived.

(4) Early-use of flexibility allowances. Manufacturers may start using a portion of the flexibility allowances in Subsections (d)(1)(C) and (d)(2)(B) for equipment and vehicles containing engines not yet subject to the Tier 4 standards, provided that the seven-year period for using flexibility allowances under the 2000 Plus Limited Test Procedures flexibility program has expired. All equipment and vehicles claimed as flexibility allowances under this early-use provision must contain engines that have been certified to, at least, the Tier 1 standards. Manufacturers must count these Tier 2 or Tier 3 equipment and vehicles toward the total percentage, or number, of flexibility allowances permitted under the provisions of Sections (d)(1)(C) and (d)(2)(B). The maximum cumulative early-use allowance is 10 percent under the percent-of-production provision in Section (d)(1)(C), or 100 units under the small volume provision in Section (d)(2)(B). Table 7 shows the applicable years for using early-use flexibility allowances. Table 7 follows:

Table 7. -- Years for Early-Use Flexibility Allowances

Maximum Engine Power	Calendar Years
kW<19	2007
19≤kW<37	2006-2011
37≤kW<56	2011
56≤kW<75	2011
75≤kW<130	2010-2011
130≤kW<225	2010
225≤kW<450	2008-2010
450≤kW≤560	2009-2010
>560 kW	--

(5) Labeling requirements. Allowances claimed under the Tier 2/3 or Tier 4 equipment flexibility programs must be labeled, as appropriate, per the following:

(A) Engine labeling. Except for engines used in flexibility allowances prior to January 1, 2007, engine manufacturers shall meet the labeling requirements provided in Section 2424 with the following substitutions:

For flexibility engines meeting previous year emission requirements, the engine manufacturer shall substitute the following for the statement of compliance required in Sections 2424(c)(1)(E)6. and 2424(c)(2):

"THIS ENGINE COMPLIES WITH CALIFORNIA EMISSION REQUIREMENTS UNDER 13 CCR 2423(d). SELLING OR INSTALLING THIS ENGINE FOR ANY PURPOSE OTHER THAN FOR THE EQUIPMENT FLEXIBILITY PROVISIONS CITED MAY BE A VIOLATION OF STATE LAW SUBJECT TO CIVIL PENALTY." [Insert Engine Family Name]

For flexibility engines less than 37 kW and not subject to emission requirements under the Tier 2/3 program, the engine manufacturer shall substitute the following for the statement of compliance required in Section 2424(c)(1)(E)6.:

"THIS ENGINE QUALIFIES FOR USE IN EQUIPMENT RATED BELOW 37 KW BY PROVISION OF 13 CCR 2423(d). SELLING OR INSTALLING THIS ENGINE FOR ANY PURPOSE OTHER THAN FOR THE EQUIPMENT FLEXIBILITY PROVISIONS CITED MAY BE A VIOLATION OF CALIFORNIA LAW SUBJECT TO CIVIL PENALTY."

As an alternative for flexibility engines produced under the Tier 2/3 program, and for which the engine manufacturer offers proof to the Executive Officer that the otherwise required statements of compliance in this subsection would be unduly burdensome or costly to implement, engine manufacturers may instead use the following:

"THIS ENGINE CONFORMS TO CALIFORNIA OFF-ROAD COMPRESSION-IGNITION ENGINE REGULATIONS UNDER 13 CCR 2423(d)." [Insert Engine Family Name if Certified]

These revised statements of compliance do not preclude the referencing of similar federal requirements that would be satisfied simultaneously by meeting the provisions of Section 2423(d). Furthermore, the Executive Officer may, upon request, approve alternate labeling specifications that are equivalent to the specifications in this subsection.

(B) Equipment Labeling. For all allowances claimed under the Tier 4 flexibility program, equipment manufacturers shall affix a permanent label to the engine, or to a readily visible section of the equipment that cannot be easily removed. The label shall be in the English language, shall supplement the manufacturer's emission control information label, and shall include the following information:

1. The label heading "EMISSION CONTROL INFORMATION".

2. The equipment manufacturer's corporate name and trademark.

3. The calendar year in which the equipment is manufactured.

4. The name, e-mail address, and phone number of a person to contact for further information.

5. The following statement:

"THIS EQUIPMENT [or identify the type of equipment] HAS AN ENGINE THAT MEETS CALIFORNIA EMISSION STANDARDS UNDER 13 CCR 2423(d)."

This label content does not preclude the referencing of similar federal requirements that would be satisfied simultaneously by meeting the provisions of Section 2423(d).

(6) Technical hardship allowances. Equipment manufacturers may apply for additional flexibility allowances should extreme and unusual circumstances occur leading to technical obstacles in complying with the Tier 4 requirements. A manufacturer may request additional allowances for power categories 19≤kW≤560 if it claims allowances under the provisions of Section 2423(d)(1)(C), but may only request additional allowances for power categories 19≤kW<56 if it claims allowances under the provisions of Section 2423(d)(2)(B). Additional flexibility allowances shall not be provided when the engine and equipment are produced by the same manufacturer, or affiliate. The Executive Officer shall review requests for additional flexibility allowances according to the following stipulations:

(A) The manufacturer requesting additional allowances must demonstrate that the circumstances necessitating them were outside the control of the manufacturer and could not have been avoided with reasonable discretion. The manufacturer must also demonstrate that it has exercised prudent planning and has taken reasonable steps to minimize the scope of the request.

(B) Manufacturers applying for additional flexibility allowances must do so in writing to the Chief of the Mobile Source Operations Division, or designee, prior to the earliest date in which the applying manufacturer would be in violation of Section 2423(b)(1). All applications shall provide, at a minimum, the following information:

1. A description of the manufacturer's equipment design process.

2. A description of the relationship with the engine supplier regarding product design.

3. An explanation of the technical hardship leading to this request, why it cannot be addressed without additional flexibility allowances, and an explanation of the circumstances behind the technical hardship and why it was unavoidable.

4. A description of the information and products provided by the engine supplier related to equipment design, including specifications, performance data, prototypes, and the dates of delivery.

5. A comparison of the design processes of the equipment model(s) for which additional allowances are needed versus those of other models that do not need additional allowances, and an explanation of how the technical differences between the models justify the request for additional allowances.

6. A description of all efforts to find and use other compliant engines, or otherwise an explanation why none are available.

7. A description of the steps taken to minimize the scope of the manufacturer's request, and any other relevant information.

8. An estimation of the number of additional allowances needed for each equipment model covered by the request, subject to Sections 2423(d)(6)(C) and (d)(6)(D) below.

Notwithstanding, the Executive Officer may require additional information as deemed necessary before making a determination for relief.

(C) The following limits shall apply for additional flexibility allowances granted in connection to the percent-of-production provisions in Section 2423(d)(1)(C):

1. A manufacturer's California-directed share of additional flexibility allowances for each power category shall be a subset of its U.S.-directed allowances for the same power category, provided that the additional U.S.-directed allowances do not exceed 70 percent of the U.S.-directed volume of production for the power category for one year.

2. All primary percent-of-production allowances must be completely used up prior to the use of any additional flexibility allowances.

3. All additional allowances shall expire 24 months after the start of the applicable flexibility usage period for each power category, as specified in Table 6. These allowances shall only be used for the specific equipment models covered in the manufacturer's written application for relief.

(D) The following limits shall apply for additional flexibility allowances granted in connection to the small volume provisions in Section 2423(d)(2)(B):

1. Only small equipment manufacturers, as defined below, that have not been granted additional flexibility allowances for the 19≤kW<56 power category under Section 2423(d)(6)(C), are eligible to request additional flexibility allowance under this provision.

"Small equipment manufacturer," for the purpose of this provision, means a federally defined small-business equipment manufacturer that had an annual U.S.-directed production volume of equipment using off-road diesel engines 19≤kW<56 of no more than 3,000 units in 2002 and all earlier calendar years, and has 750 or fewer employees (500 or fewer employees for nonroad equipment manufacturers that produce no construction equipment or industrial trucks). For manufacturers owned by a parent company, the production limit applies to the production of the parent company and all its subsidiaries and the employee limit applies to the total number of employees of the parent company and all its subsidiaries.

2. All primary small volume allowances for the 19≤kW<56 power category must be completely used up for a given year prior to the use of additional flexibility allowances.

3. Additional allowances shall only be used for equipment with engines rated 19≤kW<37.

4. A manufacturer's California-directed share of additional flexibility allowances under this provision shall be a subset of its U.S.-directed allowances, which shall not exceed 1,100.

5. All additional allowances shall expire 36 months after the start of the applicable flexibility usage period for each power category, as specified in Table 6. The allowances shall only be used for the specific equipment models covered in the manufacturer's written application for relief. The additional allowances are not subject to small volume annual limits.

(7) Notification and reporting requirements for using Tier 4 flexibility allowances. As a prerequisite to using any Tier 4 flexibility allowances, the equipment manufacturer shall notify the ARB of its intent to use such allowances. The manufacturer shall also send an annual report after each year that flexibility allowances have been used to verify that the allowances claimed do not exceed the number of allowances permitted.

(A) Before January 1 of the first year that flexibility provisions will be used, a written notice informing ARB of the manufacturer's intent to use flexibility allowances must be sent to the Chief of the Mobile Source Operations Division, or designee, containing the following information:

1. The equipment manufacturer's name and address, and the name and address of the parent company, if applicable.

2. The name and telephone number of a person to contact for more information.

3. The calendar years for which the Tier 4 flexibility provisions shall apply.

4. The engine manufacturer's name and address that produces the engines which will be used in the equipment claimed as flexibility allowances.

5. An accurate estimate of the number of flexibility allowances in each power category that will be produced under the percent-of-production provisions in Section 2423(d)(1)(C), or the small volume provisions in Section 2423(d)(2)(B).

6. A tabulation of U.S.-directed flexibility allowances in each power category that have been sold in previous calendar years under the provisions of Section 2423(d) and 40 CFR 89.102(d).

(B) For each year that Tier 4 flexibility allowances are used, the equipment manufacturer shall submit, by March 31 of the following year, a written report to the Chief of the Mobile Source Operations Division, or designee, documenting the utilization of those allowances. This report shall include the total number of equipment sold by the manufacturer during the preceding year for each power category, based on actual U.S.-directed production information, and shall identify the flexibility allowances in each power category by reporting the percentages of U.S.-directed flexibility production corresponding to the number of equipment in each power category. The report shall also identify the cumulative yearly totals and percentages for all flexibility allowances sold for each power category. Alternatively, the percentage figures may be omitted from the report if the report states that percent-of-production allowances were not used. If available, end of year percentage figures for California-directed sales shall also be included in this report.

(8) Import restrictions on the use of Tier 4 flexibility allowances. Foreign equipment manufacturers may only import equipment with exempted flexibility engines into California according to the stipulations in Section 1039.626 of the 2008 and Later Test Procedures. These stipulations address the potential for abuse whereby individual importers could collectively import more flexibility allowances than permitted, based on the foreign equipment manufacturer's total production for the United States market. The stipulations include acceptance by the foreign equipment manufacturer of random audits by the ARB or its representatives, and the posting of a monetary bond for each imported engine to cover the cost of any potential enforcement actions. Foreign equipment manufacturers who comply with the stipulations will be eligible to receive the same flexibility allowances as domestic manufacturers.

(9) Early introduction incentives for equipment manufacturers. In addition to the equipment flexibility allowances provided in Subsections (d)(1)(C) and (d)(2)(B), equipment manufacturers, as provided in the 2008 and Later Test Procedures, may

earn additional allowances for the early introduction of equipment with engines meeting the Tier 4 standards in Table 1b. Equipment manufacturers installing engines at or above 19 kW that comply with the final Tier 4 PM and NOx standards could earn one flexibility allowance for each early Tier 4 compliant engine used in its equipment. Equipment manufacturers installing engines 56≤kW≤560 that comply with the final Tier 4 PM standard and the alternative NOx standard could earn one-half of a flexibility allowance for each early Tier 4 engine used in its equipment. Table 8, below, summarizes the incentives for the early introduction of Tier 4 compliant equipment and some of the conditions that determine eligibility. Should an equipment manufacturer decline flexibility allowances earned with this provision, the allowances would then be available to the engine manufacturer that had supplied the early introduction engine, subject to the provisions in Section 2423(b)(6).

Table 8. -- Early Introduction Incentives for Equipment Manufacturers

Power Category	Qualifying Standards (g/kW-hr)	Installation Deadline	Flexibility Allowance
19≤kW<56	0.03 PM/4.7 NMHC + NOx	December 31, 2012[1]	1 for 1
56≤kW≤130	0.02 PM/0.40 NOx/0.19 NMHC	December 31, 2011	1 for 1
	0.02 PM/3.4 NOx/0.19 NMHC[2]		1 for 2
130≤kW≤560	0.02 PM/0.40 NOx/0.19 NMHC	December 31, 2010	1 for 1
	0.02 PM/2.0 NOx/0.19 NMHC[2]		1 for 2
GEN>560	0.03 PM/0.67 NOx/0.19 NMHC		
ELSE>560	0.04 PM/3.5 NOx/0.19 NMHC	December 31, 2014	1 for 1

Notes:

[1] The installation date for 37≤kW≤56 engines purchased from manufacturers choosing to opt out of the 2008 model year Tier 4 standards and instead comply with the Tier 4 standards beginning in 2012 would be December 31, 2011.

[2] To be eligible, engines must meet the 0.02 g/kW-hr PM standard and the alternate NOx standards.

(e) Recordkeeping and calculation to verify compliance. The following shall apply to off-road equipment or vehicle manufacturers and post-manufacture marinizers who produce flexibility equipment or vehicles or marine diesel engines under both the Tier 2/3 and Tier 4 flexibility provisions of paragraph (d) of this section, except as otherwise noted:

(1) For each power category in which excepted off-road equipment or vehicles or marine diesel engines are produced, a calculation to verify compliance with the requirements of paragraph (d) of this section shall be made by the off-road equipment or vehicle manufacturer or post-manufacture marinizer. This calculation shall be made for flexibility allowances under the Tier 2/3 program no later than December 31

of the year following the last year in which allowances are used, and as indicated in Subsection (d)(7)(B) for flexibility allowances under the Tier 4 program. The calculation shall be based on actual national production information from the subject years. If both the percent-of-production and small volume allowances have been exceeded, then the manufacturer is in violation of Section 2420(a)(3), except as provided under Subsection (d)(6) and paragraph (f) of this section.

(2) An off-road equipment or vehicle manufacturer or post-manufacture marinizer shall keep records of all off-road equipment and vehicles and marine diesel engines sold in California under the provisions of paragraph (d) of this section, for each power category in which flexibility allowances are claimed. These records shall include equipment and engine model numbers, serial numbers, and dates of manufacture, engine rated power for Tier 2/3 flexibility engines, and maximum engine power for Tier 4 flexibility engines. In addition, the manufacturer shall keep records sufficient to demonstrate the verifications of compliance required in paragraph (e)(1) of this section and the notifications and reports specified in Section 2423(d)(7), as applicable. All records shall be kept until at least two full years for flexibility allowances under the Tier 2/3 program and five full years for flexibility allowances under the Tier 4 program after the final year in which allowances are available for each power category, and shall be made available to the Executive Officer upon request.

(f) Economic hardship relief. Off-road equipment and vehicle manufacturers and post-manufacture marinizers may request relief from the Executive Officer, or designee, subject to the following requirements:

(1) The application for relief must be submitted for approval to the Chief of the Mobile Source Operations Division, or designee, in writing prior to the earliest date in which the applying manufacturer would be in violation of Section 2423(b)(1). The off-road equipment or vehicle manufacturer applying for hardship relief must submit evidence for approval, showing that the following requirements have been met:

(A) The off-road equipment or vehicle manufacturer applying for hardship relief must not be the manufacturer of the engines used in the equipment for which relief is sought. This requirement does not apply to post-manufacture marinizers.

(B) The conditions causing the impending violation must not be substantially the fault of the applying manufacturer.

(C) The conditions causing the impending violation must be such that the off-road equipment or vehicle manufacturer applying for hardship relief will experience serious economic hardship if relief is not granted.

(D) The off-road equipment or vehicle manufacturer applying for hardship relief must demonstrate that no allowances under paragraph (d) of this section will be available to avoid the impending violation.

(2) Any relief granted must begin within one year after the implementation date of the standard applying to the engines being used in the equipment, or to the marine diesel engines, for which relief is requested, and may not exceed 12 months (24 months for small volume manufacturers) in duration.

(3) The Executive Officer may impose other conditions on the granting of relief, including provisions to recover the lost environmental benefit. The labeling requirements in the 2008 and Later Test Procedures apply.

(g) Alternative Flexibility for Post-Manufacture Marinizers. Post-manufacture marinizers may elect to delay the effective date of the Tier 1 standards for marine propulsion diesel engines rated under 37kW by one year, instead of using the provisions of paragraphs (d) and (f) of this section. Post-manufacture marinizers wishing to take advantage of this provision must inform the Executive Officer of their intent to do so in writing before the date that the standards would otherwise take effect.

(h) Allowance for the production of engines. To meet the demand for engines created under paragraph (d), (f), or (g) of this section, engine manufacturers may produce engines that do not meet current year emission requirements. However, engine manufacturers must receive written assurance from each equipment manufacturer, prior to production, that a certain number of these engines are needed for the equipment manufacturer's Tier 4 equipment flexibility allowances. Engine manufacturers shall provide to the Executive Officer annually, as part of the certification application, a list of the equipment manufacturers requesting such engines for their Tier 2/3 and Tier 4 equipment flexibility allowances. The list shall include the equipment manufacturers' names, engine models, and estimated national production volumes. A copy of the original correspondence from the equipment manufacturer requesting the production of flexibility engines shall be kept on file by the engine manufacturer in addition to, and in accordance with, the provisions of §1039.250 of the 2008 and Later Test Procedures, and shall be made available without delay to the Executive Officer upon request. Furthermore, all engines produced for sale in California under either of the transitional flexibility provisions for equipment manufacturers, must be covered by an Executive Order starting January 1, 2007. To obtain an Executive Order for these engines, the engine manufacturer shall comply with the following:

(1) Prior to the start of production, submit a letter to the Chief of the Mobile Source Operations Division, or designee, requesting certification for flexibility engines intended for sale; in California, and

(2) Provide written assurance that the flexibility engines to be produced will be identical in all material respects to those for which a valid Executive Order has been issued in a previous model year. The engine family name of the previously certified engine family must be included in the manufacturer's request for certification. Upon determination that the conditions in paragraphs (1) and (2) have been satisfied, the Executive Officer shall provide the engine manufacturer with an Executive Order

covering the requested flexibility engine families for the current model year. The engine family names included in the Executive Order shall either be the same as, or a subset of the previously certified engine family names, and shall remain the same for as long as the engines continue to qualify as flexibility allowances regardless of model year. These engine family names shall be used by the engine manufacturer to comply with the labeling requirements of 2423(d)(5)(A).

(i) [Reserved]

(j)(1) A new compression-ignition off-road engine intended solely to replace an engine in a piece of off-road equipment that was originally produced with an engine manufactured prior to the applicable implementation date as specified in Section 2423, shall not be subject to the emission requirements of Section 2423 provided that:

(A) the engine manufacturer has ascertained that no engine produced by itself or the manufacturer of the engine that is being replaced, if different, and certified to the requirements of this article, is available with the appropriate physical or performance characteristics to repower the equipment; and

(B) unless an alternative control mechanism is approved in advanced by the Executive Officer, the engine manufacturer or its agent takes ownership and possession of the engine being replaced; and

(C) the engine manufacturer does not use the replacement-engine exemption to circumvent the regulations; and

(D) the replacement engine is clearly labeled with the following language, or similar alternate language approved in advance by the Executive Officer:

"THIS ENGINE DOES NOT COMPLY WITH CALIFORNIA AND FEDERAL OFF-ROAD OR ON-HIGHWAY EMISSION REQUIREMENTS. SALE OR INSTALLATION OF THIS ENGINE FOR ANY PURPOSE OTHER THAN AS A REPLACEMENT ENGINE FOR AN ENGINE MANUFACTURED PRIOR TO JANUARY 1 [INSERT APPROPRIATE YEAR] IS A VIOLATION OF CALIFORNIA AND FEDERAL LAW SUBJECT TO CIVIL PENALTY."

(2) At the conclusion of each of the 2000 and later model years, the manufacturer must provide, by engine model, the actual number of replacement engines produced for California during the model year, and a description of the physical or performance characteristics of those models that indicate certified replacement engine(s) were not available as per paragraph (1).

(k) Any new engine certified to comply with California emission standards and test procedures for on-road applications may, upon approval by the Executive Officer, be considered to be in compliance with these regulations.

(l) Practices and labeling requirements for rebuilt engines. This subsection shall apply as provided in paragraph (1) below to all off-road compression-ignition engines subject to the requirements of Section 2423 that are rebuilt after December 31, 2006, including those engines that were originally manufactured on, or prior to, December 31, 2006.

(1) Practices. The rebuilding practices described in Part 89.130 of the incorporated 2000 Plus Limited Test Procedures, including the exemption for engines equal to or greater than 37 kW that meet the Tier 1 standard, and Part 1068.120 of the 2008 and Later Test Procedures shall apply. These practices are summarized in paragraphs (1)(A) and (1)(B) below, which are provided as respective references for the labeling requirements in paragraphs (2)(A) and (2)(B) of this subsection.

(A) Any person who rebuilds an engine that either remains installed in a piece of equipment during the rebuilding process or will be reinstalled after the rebuilding process has been completed shall rebuild the engine to the same certified configuration or the certified configuration of a later model year engine. For the purposes of this section, these engines shall be referred to as "rebuilt original engines."

(B) Any person who replaces the engine in a piece of equipment with a rebuilt engine (this includes engines that have been substantially assembled from parts originally belonging to one or more other engines) shall use a replacement engine with a certified configuration that is at least equivalent, from an emissions standpoint, to that of the engine being replaced. For the purposes of this section, these engines shall be referred to as "rebuilt replacement engines."

(2) Labeling Requirements.

(A) Rebuilt Original Engines. Any person who rebuilds engines for which the practices in paragraph (1)(A) of this subsection apply shall ensure that the rebuilt engines are labeled as follows:

1. An original engine that is rebuilt to the same emissions configuration employed by the engine at the time it was issued an Executive Order shall retain the emissions control label described in Section 2424. The rebuilder shall not remove or deface in any manner the original label and must take care to protect it from the effects of sandblasting, acid dipping, or any other restorative processes. Notwithstanding the preceding requirements and prohibitions of this paragraph (2)(A)1., the rebuilder shall substitute a new permanent label containing the text in paragraph (2)(A)2. below for the original emission control label if the rebuilder determines that the label has been irreparably corrupted due to extreme and unintentional circumstances (e.g., fire or collision). The rebuilder shall provide to the Executive Officer annually a list of all rebuilt engines for which original labels have been removed under this provision no later than two months after the end of each calendar year. The rebuilder shall retain all removed labels, or otherwise document the degree to

which the labels were damaged or missing (e.g., photographic proof of the corruption), for a period of no less than eight years following the date of renovation, and shall make these available to the Executive Officer upon request. The rebuilder shall be subject to civil penalty under State law should the Executive Officer determine that the original emission control label did not warrant replacement or that the rebuilder is abusing this provision;

2. An original engine that is rebuilt to a more stringent emissions configuration shall be permanently re-labeled using the following text:

"THIS ENGINE HAS BEEN REBUILT UNDER 13 CCR 2423(l) USING MATCHED COMPONENTS OF THE SAME SPECIFICATIONS AND CALIBRATIONS AS THOSE OF A CERTIFIED TIER [insert the numerical tier designation of the rebuilt engine] OFF-ROAD COMPRESSION-IGNITION ENGINE. IF PLACED INTO SERVICE IN AN OFF-ROAD APPLICATION, THIS ENGINE MUST BE INSTALLED IN EQUIPMENT ORIGINALLY SOLD WITH A TIER [insert the numerical tier designation of the rebuilt engine] OR EARLIER ENGINE. [insert the engine family name of the reference engine].

For the purpose of this label, "MATCHED" means a complete set of components corresponding to the certified emissions configuration being referenced (see the definition of "certified emissions configuration" in Section 2421(a)(13)). The reference engine is the engine family name corresponding to the certified emissions configuration to which the engine has been rebuilt. The label shall conform to the provisions of Section 2424 regarding location and visibility.

(B) Rebuilt Replacement Engines. Any person who rebuilds engines for which the practices in paragraph (1)(B) of this subsection apply shall ensure that the rebuilt engines are labeled as follows:

1. A replacement engine that is rebuilt to the same California emissions configuration employed by the engine at the time it was issued an Executive Order shall either retain the emission control label described in Section 2424 or be permanently re-labeled using the text in paragraph (2)(A)2. of this subsection. A replacement engine that is rebuilt to the same emissions configuration employed by the engine at the time it was issued a federal Certificate of Conformity, and for which no Executive Order exists, shall be permanently re-labeled using the text in paragraph (2)(A)2. of this subsection prior to being installed in equipment that was originally sold with a California certified engine;

2. A replacement engine that is rebuilt to a more stringent emissions configuration shall be permanently re-labeled using the text in paragraph (2)(A)2. above;

3. An incomplete rebuilt replacement engine shall be permanently re-labeled using the text specified below. For the purposes of this subsection, "incomplete rebuilt replacement engine" means a rebuilt replacement engine that is sold or offered for sale in California without all the necessary components to enable engine operation including, but not necessarily limited to, the fuel system and the air system:

"THIS ENGINE HAS BEEN REBUILT UNDER 13 CCR 2423(l) AS AN INCOMPLETE ENGINE USING ONLY MATCHED COMPONENTS OF THE SAME SPECIFICATIONS AND CALIBRATIONS AS THOSE FOUND IN OFF-ROAD COMPRESSION-IGNITION ENGINES CERTIFIED TO THE [insert the numerical tier or multiple tiers designation of the rebuilt engine]."

Any person who completes an incomplete rebuilt replacement engine with components that are not matched components, and the resulting engine is placed into service in California, is in violation of the rebuilding practices referenced under paragraph (1) of this subsection and subject to civil penalty under State law.

(C) Supplemental Labeling Requirements. Except as noted below, any person who sells or offers for sale any rebuilt engine subject to the provisions of subsection (l) shall affix a supplemental label to the rebuilt engine that:

1. states the name of the rebuilder, year of rebuild, and other pertinent information as determined by the rebuilder or specified by the Executive Officer; and

2. is clearly visible without the need to remove any engine components; and

3. does not obscure in any way the visibility of the original emission control label or the labels required under paragraphs (2)(A)2. or (2)(B)3. of this subsection; and

4. does not state or imply that the rebuilt engine is "new" or that it belongs to an engine family other than the one to which it was originally certified; and

5. has sufficient durability to remain intact and legible throughout all mandatory record keeping periods for rebuilt engines.

The requirement for a supplemental label shall be waived in cases where the rebuilder alternately chooses to incorporate the information in (C)1. above into the new permanent label specified in subsection (2)(A)2. or (2)(B)3.

(D) Rebuilt New Engines. Notwithstanding any other requirement of this subsection (l), any person who rebuilds an engine to comply with current-year emission requirements (including, but not limited to, durability and warranty), with

the intent to sell or offer for sale the rebuilt engine as "new" under the coverage of a new and unique Executive Order, shall replace the original emission control label on that engine with one identifying the engine as belonging to a family meeting current-year emission requirements in accordance with the provisions of Section 2424. If desired, the rebuilder of a such an engine may optionally affix to it a supplemental label, but such a label would be required to comply with the same requirements specified in paragraph (C) of this subsection for any other rebuilt engine.

Note: Authority cited: Sections 39600, 39601, 43013, 43018, 43101 and 43104, Health and Safety Code. Reference: Sections 43013, 43017, 43018, 43101, 43104 and 43211-43212, Health and Safety Code.

§ 2485.0.1. Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling. (Alternative)

For purposes of this section, any cross-referenced section in title 13 or title 17 of the California Code of Regulations shall refer to the section identified as the alternative version "(Alternative)" for the corresponding section, to the extent an alternative version of that section exists.

(a) Purpose. The purpose of this airborne toxic control measure is to reduce public exposure to diesel particulate matter and other air contaminants by limiting the idling of diesel-fueled commercial motor vehicles.

(b) Applicability. This section applies to diesel-fueled commercial motor vehicles that operate in the State of California with gross vehicular weight ratings of greater than 10,000 pounds that are or must be licensed for operation on highways. This specifically includes:

(1) California-based vehicles; and

(2) Non-California-based vehicles.

(c) Requirements.

(1) Idling Restriction. On or after February 1, 2005, the driver of any vehicle subject to this section shall comply with the following requirements, except as noted in subsection (d) below:

(A) the driver shall not idle the vehicle's primary diesel engine for greater than 5.0 minutes at any location.

(B) the driver shall not operate a diesel-fueled auxiliary power system (APS) to power a heater, air conditioner, or any ancillary equipment on that vehicle during sleeping or resting in a sleeper berth for greater than 5.0 minutes at any location when within 100 feet of a restricted area.

(2) Use of Alternative Technologies.

(A) On or after January I, 2008, the driver shall not operate an internal combustion APS on any vehicle equipped with a 2007 and subsequent model year primary diesel engine unless the vehicle is:

1. equipped with an APS meeting the emissions performance requirements found in subsection (c)(3)(A), below; and

2. the vehicle is equipped with a label meeting the requirements pursuant to section 35.B.4 of the "California Exhaust Emission

Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," as incorporated by reference in title 13, CCR, section 1956.8(b).

(B) On or after January I, 2008, the driver shall not operate a fuel-fired heater on any vehicle equipped with a 2007 and subsequent model year primary diesel engine unless the fuel-fired heater meets the emissions performance requirements found in subsection (c)(3)(B), below;

(C) On or after January 1, 2008, the driver of a vehicle equipped with a 2006 or older model year primary diesel engine may use and operate in California any certified internal combustion APS with or without the additional PM control specified in subsection (c)(3)(A)1, or any other certified alternative idling reduction technology.

(3) Compliance Requirements. As an alternative to idling the primary engine, diesel engines/vehicles may, as an option. be equipped with alternative technologies, as listed and defined below in (A), (B), and (C) of this subsection. If so equipped, these technologies are subject to the following requirements:

(A) Internal Combustion APS.

1. In order to operate in California, an APS utilizing an internal combustion engine must comply with applicable California off-road and/or federal non-road emission standards and test procedures for its fuel type and power category. In addition, diesel-fueled APSs installed on vehicles equipped with primary engines certified to the 2007 and subsequent model year heavy-duty diesel engine standards, pursuant to section 1956.8(a)(2)(A) of title 13, CCR, shall either,

a. be equipped with a verified Level 3 in-use strategy for particulate matter control (see title 13, CCR, sections 2700 to 2710), or

b. have its exhaust routed directly into the vehicle's exhaust pipe, upstream of the diesel particulate matter aftertreatment device.

2. With advance Executive Officer approval, a certifying/verifying APS manufacturer may petition for an alternate compliance strategy other than described in (A)1. a. or b. in this subsection above. However, this provision is limited to manufacturers that can demonstrate, to the satisfaction of the Executive Officer, that their alternative strategy is equivalent (or "cleaner"), from an emissions standpoint, compared to the requirement described in (A)1.a. or b. in

this subsection above. As an example, strategics that can use the available electric power infrastructure, instead of solely operating a diesel-fueled APS for engine and/or cab heating and cooling, may be able to use such a strategy to demonstrate compliance with these requirements.

(B) Fuel-Fired Heaters. Fuel-fired heaters must comply with the applicable California emission standards and test procedures as specified in the Low Emission Vehicle program requirements found in title 13, CCR, subsections 1961(a)(15) and (d), or in Part I.E.1.13 of the "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 through 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," and the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," ," as incorporated by reference in title 13, CCR, section 1961(d). However, the specified requirement that limits fuel-fired heaters from being operated above 40°F does not apply.

(C) Other Idle Reduction Technologies. Other technologies that will reduce idling emissions may also be used, including the use of batteries, fuel cells, power inverter/chargers for on-shore electrical power, on-shore electric power infrastructure also known as truck stop electrification, and other technologies that produce minimal or no emissions. With the exception of battery and fuel cell powered APSs, power inverter/chargers, and electric power infrastructure, the use of other technologies are subject to advance Executive Officer approval and must be at least as effective in reducing idling emissions as the technologies described in subsections (c)(3)(A), above, or the NOx idling emission standard specified in title 13, CCR, section 1956.8(a)(6)(C). The Executive Officer shall use good engineering judgment and test data to determine if an idle reduction technology provides idling emission controls equivalent to the standards specified in subsection (c)(3)(A) above, or in title 13, CCR, section 1956.8(a)(6)(C).

(D) Labeling Requirements. 2007 and subsequent model year commercial diesel vehicles equipped with an internal combustion APS meeting the requirements specified in subsection (c)(3)(A) shall have a label affixed to the hood of the vehicle to allow operation of the APS in California. The labels shall meet the requirements specified in section 35.B.4 of the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," as incorporated by reference in title 13, CCR, section 1956.8(b).

(d) Exceptions.

(1) Except when a vehicle is located within 100 feet of a restricted area. subsection (c)(1)(A) does not apply, if the vehicle is equipped with

(A) a primary diesel engine meeting the optional NOx idling emission standard pursuant to title 13, CCR, section 1956.8(a)(6)(C); and

(B) a label meeting the requirements pursuant to section 35.B.4 of the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," as incorporated by reference in title 13, CCR, section 1956.8(b).

(2) Subsection (c)(1) does not apply for the period or periods during which

(A) a bus is idling for

1. up to 10.0 minutes prior to passenger boarding, or

2. when passengers are onboard;

(B) prior to January 1, 2008, idling of the primary diesel-engine is necessary to power a heater, air conditioner, or any ancillary equipment during sleeping or resting in a sleeper berth. This provision does not apply when operating within 100 feet of a restricted area;

(C) idling when the vehicle must remain motionless due to traffic conditions, an official traffic control device, or an official traffic control signal over which the driver has no control, or at the direction of a peace officer, or operating a diesel-fueled APS or other device at the direction of a peace officer;

(D) idling when the vehicle is queuing that at all times is beyond 100 feet from any restricted area;

(E) idling of the primary diesel engine, operating a diesel-fueled APS, or operating other devices when forced to remain motionless due to immediate adverse weather conditions affecting the safe operation of the vehicle or due to mechanical difficulties over which the driver has no control;

(F) idling to verify that the vehicle is in safe operating condition as required by law and that all equipment is in good working order, either as part of a daily vehicle inspection or as otherwise needed, provided that such engine idling is mandatory for such verification;

(G) idling of the primary diesel engine, operating a diesel-fueled APS, or operating other devices is mandatory for testing, servicing, repairing, or

diagnostic purposes, including regeneration or maintenance of the exhaust emission control device during engine idling when the dashboard indicator light, if so equipped, is illuminated indicating that regeneration or maintenance is in progress;

(H) idling when positioning or providing a power source for equipment or operations, other than transporting passengers or propulsion, which involve a power take off or equivalent mechanism and is powered by the primary engine for:

1. controlling cargo temperature, operating a lift, crane, pump, drill, hoist, mixer (such as a ready mix concrete truck), or other auxiliary equipment;
2. providing mechanical extension to perform work functions for which the vehicle was designed and where substitute alternate means to idling are not reasonably available; or
3. collection of solid waste or recyclable material by an entity authorized by contract, license, or permit by a school or local government;

(I) idling of the primary diesel engine, operating a diesel-fueled APS, or operating other devices when operating defrosters, heaters, air conditioners, or other equipment solely to prevent a safety or health emergency;

(J) idling of the primary diesel engine, operating a diesel-fueled APS, or operating other devices by authorized emergency vehicles while in the course of providing services for which the vehicle is designed;

(K) idling of military tactical vehicles during periods of training, testing, and deployment; and

(L) idling when operating equipment such as a wheelchair or people assist lift as prescribed by the Americans with Disabilities Act.

(M) idling of armored cars in the course of providing services for which the vehicle is designed; and

(N) idling of workover rigs while performing work for which the vehicle is designed

(e) Relationship to Other Law.
Nothing in this section allows idling in violation of other applicable law, including, but not limited to:

(1) California Vehicle Code Section 22515;

(2) Title 13, Section 2480. California Code of Regulations;

(3) California Health and Safety Code Section 40720; or

(4) any applicable ordinance. rule, or requirement as stringent as, or more stringent than, this section.

(f) Enforcement. This section may be enforced by the Air Resources Board; peace officers as defined in California Penal Code, title 3, chapter 4.5, Sections 830 et seq. and their respective law enforcement agencies' authorized representatives; and air pollution control or air quality management districts.

(g) Penalties. For violations of subsection (c)(1), (c)(2) or (c)(3), the driver of a subject vehicle is subject to a minimum civil penalty of 300 dollars and to criminal penalties as specified in the Health and Safety Code and the Vehicle Code.

(h) Definitions.

The following definitions apply to this section:

(1) “Armored car” is as defined in Vehicle Code Section 115

(2) "Authorized emergency vehicle" is as defined in Vehicle Code Section 165.

(3) "Auxiliary power system" or "APS" means any device that is permanently dedicated to the vehicle on which it is installed and provides electrical, mechanical, or thermal energy to the primary diesel engine, truck cab and/or sleeper berth, bus's passenger compartment or any other commercial vehicle's cab, as an alternative to idling the primary diesel engine.

(4) "Bus" means any vehicle defined in Title 13, California Code of Regulations, Section 2480, subsections (h) (13)-(16), inclusive or as defined in the Vehicle Code Section 233.

(5) “Child care facility” is a facility that meets the definition of a “child day care facility” in Health and Safety Code section 1596.750 and that is subject to the requirements of Health and Safety Code sections 1596.7 to 1597.71.

(6) "Commercial Motor Vehicle" means any vehicle or combination of vehicles defined in Vehicle Code Section 15210(b) and any other motor truck or bus with a gross vehicle weight rating of 10,001 pounds or more, except the following:

(A) a zero emission vehicle; or

(B) a pickup truck as defined in Vehicle Code Section 471.

(7) "Driver" is as defined in Vehicle Code Section 305.

(8) “Executive Officer” means the Executive Officer of the California Air Resources Board or his or her delegate.

(9) "Fuel-fired heater" means a fuel burning device that creates heat for the purpose of (1) warming the cab or sleeper berth compartment of a vehicle or (2) warming the engine oil and/or coolant for easy start-up of the vehicle's engine but does not contribute to the propulsion of the vehicle.

(10) "Gross vehicle weight rating" is as defined in Vehicle Code Section 350.

(11) "Highway" is as defined in Vehicle Code Section 360.

(12) "Idling" means the vehicle engine is running at any location while the vehicle is stationary.

(13) “Motor Carrier” means a person providing transportation of goods or passengers for compensation.

(14) "Motor truck" or "motortruck" means a motor vehicle designed, used, or maintained primarily for the transportation of property.

(15) "Official traffic control device" is as defined in Vehicle Code Section 440.

(16) "Official traffic control signal" is as defined in Vehicle Code Section 445.

(17) "Owner" means the person or persons registered as the owner of the vehicle by the California Department of Motor Vehicles or its equivalent in another state, province, or country (presumed at the time of violation to be the person or persons identified as the owner on the registration document or title carried on the vehicle). For the purposes of this section, the definition of an owner excludes a lessor or a renter who leases or rents vehicles without a driver for a fixed rate or price, and does not operate or permit to operate the vehicle at the time of violation.

(18) “Person” means an individual, corporation, business trust, estate, trust, partnership, limited liability company, association, joint venture, government, governmental subdivision, agency, instrumentality, public corporation, or any other legal or commercial entity.

(19) "Primary diesel engine" means the diesel-fueled engine used for vehicle propulsion.

(20) "Queuing" means (A) through (C)

(A) the intermittent starting and stopping of a vehicle;

(B) while the driver, in the normal course of doing business, is waiting to perform work or a service; and

(C) when shutting the vehicle engine off would impede the progress of the queue and is not practicable.

(D) Queuing does not include the time a driver may wait motionless in line in anticipation of the start of a workday or opening of a location where work or a service will be performed.

(21) "Restricted area" means any real property zoned for individual or multifamily housing units that has one or more of such units on it.

(22) "Safety or health emergency" means:
(A) a sudden, urgent, or usually unforeseen, occurrence; or
(B) a foreseeable occurrence relative to a medical or physiological condition.

(23) "Senior care facility" is a facility that meets the definition of "residential care facility for the elderly" in Health and Safety Code section 1569.2(k) and that is subject to the requirements of the California Residential Care Facilities for the Elderly Act (Health and Safety Code sections 1569 to 1569.889).

(24) "Sleeper berth" is as defined in Title 13, California Code of Regulations. Section 1265.

(25) "Vehicle" is as defined in the Vehicle Code Section 670.

(26) "Workover rig" is as defined in Section 2449 of Title 13, California Code of Regulations.

(i) Severability. If any section, paragraph, subparagraph, sentence, clause, phrase, or portion of the section is, for any reason, held invalid, unconstitutional, or unenforceable by any court of competent jurisdiction, such portion shall be deemed as a separate, distinct, and independent provision, and such holding shall not affect the validity of the remaining portions of this section.

NOTE: Authority cited: Sections 39600, 39601, 39614(b)(6)(A), 39658, 39667, 43000.5(d), 43013(b), 43013(h), 43018(b) and 43018(c), Health and Safety Code; and *Western Oil & Gas Assn. v. Orange County Air Pollution Control Dist.* (1975), 14 Cal.3d.411. Reference: Sections 39002, 39003, 39027, 39500, 39600, 39650, 39655, 39656, 39657, 39658, 39659, 39662, 39665, 39674, 39675, 42400, 42400.1, 42400.2, 42400.3, 42402, 42402.1. 42402.2, 42402.3, 42403.5, 42410, 43013, 43018 and 43704, Health and Safety Code; Sections 305, 336, 350, 440, 445, 545, 546, 642, 680, 21400,

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22452, 22515, 27153, 40001 and 40001(b)(5), Vehicle Code; and *Western Oil & Gas Assn. v. Orange County Air Pollution Control Dist.* (1975), 14 Cal.3d.411.